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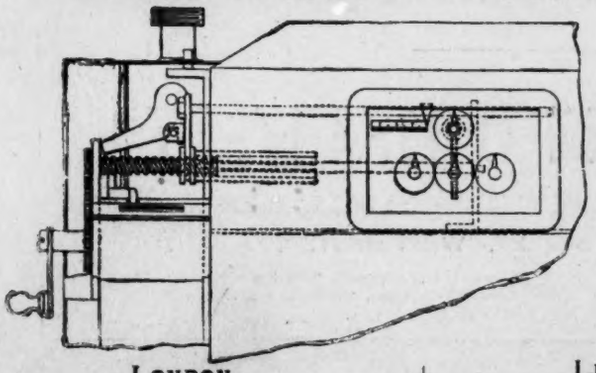

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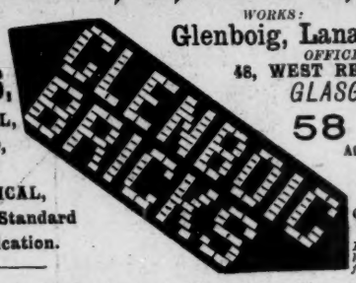

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VOL. CXLVIII., No. 2954.] TUESDAY, DECEMBER 23, 1919. [71ST YEAR.

EDITORIAL NOTES.

Greetings.

WE wish our readers in whatever branch of the industry they may be, or whatever their interests in association with it, a Happy Christmas. Many a family circle, we know, is now smaller than it used to be, owing to a war ingloriously waged by our enemies, but gloriously won by the allies. Those who have "Gone West" are our heroes; and men such as they, there is certainty, would wish that the annual festival should be kept as of old. The burdens of the present are, and of the immediate future will be, heavy; but we have to think of those about us—especially those who are young, and on whom the work hereafter will fall. For them, we want bright memories. We ourselves, too, have to look forward, and have to bear the responsibility of straightening out the great tangle of affairs, and to work for development. We shall do all this the better—our duty will be performed with stronger heart—by letting sunshine pierce and scatter any gloom that may be upon us. Then for many reasons let the morrow be as far as possible as of yore. It will be good for all.

For those in the industry, or concerned in it as investors, there is better reason this year than last for looking forward to brighter conditions. We have still labour demands awaiting settlement. But in the labour world, the truth is gaining ground that there is a limit to all things; that even wages and hours must arrive at a point where they become destructive of economic conditions, and (this goes home) of employment, and are therefore incapable of being maintained. As this truth obtains wider circulation and appreciation, we may hope for more reasonable conditions in the labour world. Again rays of light are beginning to penetrate the cloud of financial injustice to existing gas capital; and there is good prospect of a revision of our circumstances in this regard. Parliament just now is up in arms against injustice to invested capital, against any obstruction to the flow of new capital into industry, and against hindrances to the development of private enterprise which is the foundation of the prosperity that this country has enjoyed. There is now good hope, too, of greater liberty being given to our gas manufacturing and trading operations. True there is to be a departure from old-established customs; but it is only by such departures that progress is made. In the gas industry we have been too conventional, too conservative. There has to be a change. Everything is urging us to make headway by bringing to the credit of our operations and trading all that efficiency and economy can offer. Therefore, there is less to depress the industry this year than last, so far as the outlook is concerned, although in mind is the knowledge that, until the goal is won, there cannot be perfect confidence. However, the prospect is brighter. Then let Christmas ring, as far as possible, with the old rejoicing.

Private Bills and Heat-Unit and Sliding-Scale Revision.

THERE are now before us the Bills in which it was foreshadowed by the Parliamentary Notices that provision would be made for changing the operations of the companies on to a heat-unit basis, and in which financial revision would be sought. We still deplore the fact that there exists a single Private Bill dealing with these matters; but the position has undergone some change from that which was anticipated through certain public references a few months ago, and even from that which the industry was led to expect so recently as the publication of the Parliamentary Notices. To-day, the Bills show us that we are nearer solidarity than before, in the matter of leaving the industry in the hands of the Board of Trade through the General Bill which they are to promote. There are now only two breaks in the ranks; and these are supplied by the South Metropolitan and South Suburban Companies, the latter of whom would, we believe, have willingly withdrawn their Bill had they been satisfied that it would injure the chances of other undertakings. But the proposals of the two Companies are not of a character that will clash to any very appreciable extent (if anticipations are correct) with the proposals that will be put forward by the Board of Trade; and expectations are that, despite the plans of the Companies, the differences between their proposals and the Board's will be levelled, and so harmony with the general legislation will be effected. The narrowing-down of independent promotion has been achieved by the withdrawal of the Commercial Gas Company's Bill; and the Wandsworth and Brighton Companies have in their Bills made provision to adopt any General Act that is passed. In respect of the financial change, the Brighton Company only ask for their standard price to be increased to 4s. 9d. per 1000 c.ft. But when the Board of Trade Bill is passed, the standard price will have to conform to the heat-unit basis of charging.

Concerning the South Metropolitan and South Suburban Bills, there is unreserved adoption of the amended Beilby report. We are glad to see this. The modifications were only agreed to in October; but twice before then, there were positive statements as to the preparedness of the South Metropolitan Company's Directors to promote legislation to carry out the original report. The fact that they have accepted the agreed modifications of the Beilby report is evidence that they have now no desire to create precedents, in certain particulars, that might be irksome to other gas undertakings. The only departure from the Beilby report as modified is one that is intended to reward the Company for good conduct in respect of carbon bisulphide; but it introduces a little complication and indefiniteness from the point of view of the consumer. It is that, if "the testing of "the gas supplied by the Company during such year or half "year has shown the gas to contain, on an average, less than "one part by volume of carbon bisulphide vapour per 40,000 "volumes of gas, then, notwithstanding any other provi-"sions of this Act, the sum payable by consumers taken into "calculation in determining the consumers' share . . . "shall be deemed to have been ¼d. per standard unit less "than the sum actually payable." In all other respects, the Company (in the deposited Bill) accept the amended Beilby report: The 100,000 B.Th.U. as the gas unit, continuous recorders, restrictions as to inerts, and pressure. In the Bill, the Company do not (there is no reason why they should) mention the calorific value they propose to declare in the first instance; but the South Suburban Company do. They have 450 B.Th.U. for their whole area of supply; but the succeeding clause proposes to give the Company power, from time to time, "at their discretion," to vary, "as regards either the whole or any part or parts of the "area of supply, the prescribed standard calorific value of "the gas supplied by them . . . and may fix different "standards of calorific value for different parts of that area" —this upon giving not less than six months' notice to the local authority or authorities concerned. Regarding the readjustment of consumers' appliances, the South Metropolitan Company undertake to do this with all reasonable speed, and without charge to consumers; but the South Suburban Company propose to carry out readjustments free of cost at any time within one year of a variation of calorific power, "if and when required by any consumer of gas," which means that the consumer is to be left to judge whether or not his appliances require adjustment, and not

one of the Company's own experts, which we do not think is quite in accord with the spirit of the recommendation of the Board of Fuel Research.

Coming to the parts of the Bills dealing with financial revision. It is obvious that this has been the more difficult part with which to deal. There are the interests of three parties to be considered; and more especially in these times. The holders of existing stock should not suffer from the fact that they are investors in statutory gas undertakings, and not in ordinary commercial concerns; and the return on the capital must, under the changed conditions of the time, be made sufficiently attractive to ensure the inflow of new capital. This is a condition that is not only necessary from the point of view of the stockholders, but from the points of view of the consumers and of the workers, who naturally desire the maintenance and extension of employment. At the same time, the division of the surplus profits, however derived, must be such as to ensure that the largest proportion goes to the gas consumers. The South Metropolitan Company have devised quite a new system of dealing with surplus profits. The South Suburban Company have prepared a plan running as near as possible on the lines of the old sliding-scale; and this is (apart from differences of condition in the two Companies) a justification for them taking a higher standard or basic price. Conversely, the South Metropolitan Company do not suggest any reduction of their proposed standard dividend (6 p.ct.) should the charge for gas exceed the basic price; and therefore this may also be a reason for the lower basic price. The 6 p.ct. in the case of the South Metropolitan Company, it seems to us, becomes a minimum, unless the price charged does not produce sufficient profit to allow it to be paid. The basic price proposed by the South Metropolitan Company is 11d. per standard unit (100,000 B.Th.U.), and the standard price desired by the South Suburban Company is 1s. 2d. per unit. Converted to per 1000 c.ft., these figures would give higher standard prices than the old ones; and this is necessary having regard to the new levels of costs. The South Metropolitan Company have put their authorized rate of dividend at 6 p.ct. on the 4 p.ct. ordinary stock, which is quite fair in the new circumstances, and is only ½ p.ct. or so more than the average dividend of the five years that preceded the war. The South Suburban Company are also asking for 6 p.ct., which is their pre-war dividend on the 5 p.ct. stock.

This brings us to the new method by which the South Metropolitan Company propose to deal with any surplus profits when the charge for gas is below the basic price of 11d. per unit. As worded in the Bill, the proposal has not so much clarity about it that it can be understood at a glance. "Surplus profits," it appears to us, are in this case something that in respect of the greater part has no tangibility or existence, but has already been put into the possession of the consumers by the price charged being below the basic price. The so-called surplus profits are to be divided in the proportions of three-fourths to the consumers, and one-fourth is to go equally to the ordinary stockholders and the employee co-partners. The surplus profits are to be "calculated" at the end of each year or half year. First of all there has to be taken into account the sum by which "the total amount payable by consumers during each year "or half year has been less than the amount which would have "been payable if the gas had been charged for at the basic "price, and such sum so calculated shall be called 'the "'consumers' share;' and for the purposes of this section "'the surplus profits' shall mean a sum of which the con-"sumers' share is three-quarters." Then, if the balance, after providing for the authorized dividends, in the opinion of the Directors permits, a sum not exceeding one-quarter of the surplus profits is to be applied in two equal parts for the benefit of the holders of the ordinary stock and the employee co-partners. This, again, is equitable, if our interpretation is correct. It is a pity the Directors did not, to remove any doubt, give an illustration of their meaning in a schedule. What we understand by the plan (and we shall be glad to be put right if wrong) can be explained by a microscopic illustration. Supposing the sales of the Company were only 100 gas units. This at the basic price of 11d. would bring in £4 11s. 8d. Supposing the 100 units were sold at 8d., the actual revenue would be £3 6s. 8d. The consumers would therefore have benefited to the extent of £1 5s. below the basic price. That is the "consumers' "share," which is calculated as three-quarters of the "surplus "profits." To arrive at the "surplus profits" one-third of the £1 5s. has to be added (8s. 4d.). This makes £1 13s. 4d., a quarter of which, 8s. 4d., is to be equally divided between the ordinary stockholders and the employee co-partners. We hope there has been success in interpreting the proposal. How the South Suburban Company are suggesting to adjust the sliding-scale to the new conditions will be seen by reference to the extracts from the Bill on p. 662.

The South Suburban Company are, it appears from the clauses, prepared to take a sporting chance in relation to dividend. They are proposing to forego anything above 6 p.ct. to which the stockholders might be entitled through improving conditions, or the fruits of manufacturing economies, until after June 30, 1926. On the other hand, it is proposed that no power of application for revision of the standard price shall be made to the Board of Trade by either the Company or the local authorities before Jan. 1, 1926. On first consideration, it seems to us this is not at all a bad condition. The next few years will be uncertain ones, though the view is strong that there will be better conditions. Even so, it is well to have a period in which to allow conditions to stabilize themselves as far as possible; and, by the time named, there would have been good opportunity of testing whether the standard price is a fair one. There may be objection to these proposals on the part of other gas companies. It shows, at any rate, that the South Suburban Company are quite prepared to make a bargain, and submit to a re-examination of the position, at the end of a term of years. But the proprietors must not jump to the conclusion that the Company (this also applies to other companies) would be able, assuming the Bill meets with the approval of Parliament, to pay a 6 p.ct. dividend straight away. The profits are not likely to allow this for some time ahead, despite improvement in conditions.

In the Bills we do not see a clause contemplating any alteration of standard prices in consideration of changes in the cost of coal. This has been a matter of some discussion in gas circles; and it is one that has become of considerable importance and anxiety since coal prices have been making such vagarious movements. A point on which there is some difference of opinion is as to whether any proposal in this respect should be based on the price delivered on to the works, or at the pithead, or the f.o.b. price. There are arguments both for and against; and they apply the more the greater the distance of the coal sources from the works. Railway rates are likely to go up; and in this case it would be an advantage to have the price of coal delivered on to the works. But shipping freights are bound to come down; and it would not be an advantage to have standard prices that are fixed now subject to such an unknown quantity as this. Again works may be constructed on new sites—we might instance the Belvedere works of the South Suburban Company—which may enable economies to be effected in the cost of coal delivered compared with costs on the old sites. These economies should not be allowed to bring about a reduction of the standard price. It is a problem that requires very careful handling; and it is clear that, if the cost of coal delivered on to the works is proposed, there should be some qualifying clause that will give protection in certain events.

Complete Gasification Rooted in the Industry.

SOME eminently good work has been done for the gas industry by Mr. C. B. Tully; and it is bearing fruit to-day, especially in small and medium size provincial gas-works, where the making of the maximum quantity of gas from the coal purchased is of more importance than the obtaining of secondary products. Several works that are low down the scale of magnitude have, during the war—owing to the difficulties of procuring coal and of the prices of both coal and labour, together with the utter impossibility of securing capital—been in dire straits; and often and often the question has been in mind as to whether it was worth while struggling longer against adversity. The plant with which Mr. Tully's name is associated has come in, and has relieved the situation. The reasons for this are not far to seek. It asks a low capital outlay per 1000 c.ft. of production; completely gasifying the coal, it works at a high thermal efficiency; and the labour required for it is almost negligible. There is a reduction of costs from beginning to end; and the works relying solely upon the system hasno business. to concern it other than that of generating and selling gas It is the aim of Mr. Tully to turn the gas-works into one-product places, like electricity stations, but with simi-

larity from the thermal efficiency standpoint. His idea is to put into the gasholders (as he is putting) some 80 p.ct. of the potential heat value of the coal, instead of having the 80 p.ct. distributed between gas, coke, and tar. The super-electricity stations of which so much is heard are only expected, under favourable conditions, to attain a 20 p.ct. efficiency. The principle of the system is the simultaneous gasification of coal and the production of water gas in the same plant. We see in it a modified form of the well-known generator that Mr. Tully and (the late) Prof. Lewes designed, with the grate varied to deal with any class of coal that it is desired to use. Of course, such a plant can be incorporated in any gas-works as a supplement to, or in substitution of, the ordinary system of carbonizing. When it is learned that there are about thirty of the plants in operation, and about eighty contracts in hand for works of different sizes, it will be appreciated that a new condition of affairs has arisen in the gas industry, and that gas officials are not to-day by any means slow in taking advantage of the relief offered.

It is the view of Mr. Tully that the future will see a 400 to 425 B.Th.U. gas fairly general practice; and there are plants on his system which are to-day turning out (without any secondary products) some 60,000 c.ft. of 400 B.Th.U. gas per ton of second-rate coals (highly bituminous ones are not desirable), which means 24 million B.Th.U. in the form of gas, or about 80 p.ct. of the heat value of the coal. It also means that, compared with ordinary coal carbonization with 6,000,000 or so B.Th.U., there is, in relation to B.Th.U., a saving of approximately 75 p.ct. of coal. A small amount of tar is produced, which in its constitution is very much like Mond gas tar. An interesting feature, in view of the Board of Fuel Research report, is that the inerts in the gas come well within the proposed prescription; and there is no reason why they should not be kept to 10 or 12 p.ct. The plant is capable of regulation to any conditions desired; and it is just as easy to make with it gas of 500 B.Th.U. as gas of 400 B.Th.U. There is no doubt that, in view of the considerably higher costs of coal and labour, the complete gasification of coal is the right thing under certain conditions. But conditions vary; and the secondary products of coal carbonization are essential. Complete gasification in the gas industry is not therefore likely to become universal practice, though we believe the time is at hand when (the balance-sheet will decide the matter) it will be applied to a substantial proportion of the coal that the gas industry will be called upon to carbonize as the consumption of gas for domestic and industrial purposes increases. However, all that is done in the way of complete gasification will improve the market conditions for secondary products for the undertakings making them, in comparison with what would be the case if nothing but straight coal gas were manufactured. This in degree applies also to the utilization of water-gas separately made, and the steaming of charges in retorts. Regarding the latter system, Mr. Tully, in the article in another column descriptive of his fast developing experiences with complete gasification under different conditions, quotes Prof. Lewes's dictum that steaming is, and must always be, a failure. Had Prof. Lewes been with us to-day, he would have had substantial cause for revising that belief. However, the main thing is that complete gasification of coal has rooted itself in the gas industry, and there it is likely to stay as a recognized part of its system.

The Government and the Electricity Bill.

THE Electricity Supply Bill has been so cut and mauled about that there is little body left in it; and a skeleton, with a modest amount of flesh hanging about its bones, is all that remains. The responsibility for this rests entirely with the Government. All the compulsory part of the measure has been dropped, in order to save the power to establish the Electricity Commissioners, and give them a start on their work, although precisely what they will be able to do that will be of genuine value, until they know the fate next session of the portions of the scheme that have been suspended, we do not know. All the compulsory powers for the institution of District Electricity Boards and the acquisition of generating stations and transmission lines have been withdrawn from the Bill. The financial authorization has been limited to a 20 million loan for prosecuting work urgently necessary, though to this there was the strongest objection. However, the dropping of these parts of the Bill is only a temporary matter. They are to be packed together in a second Bill next session, and then controversy over them will have full play.

The Government were compelled to abandon for the time being the parts of the Bill which threatened to wreck it completely; and they were most wise. To deny any industry legislation that—providing it is reasonable, and does not injuriously affect the interests of other essential industries—will enable it to develop its public service on the best lines is unquestionably wrong. And nobody wishes to deny the electricity industry all that is right and proper. Fortunately, those who opposed the Bill in the House of Lords had on their side a considerable part of the richest intellect in the electricity industry; and their Lordships, who gave utterance to their objections were only saying what many men in the House of Commons thought, but to which they did not out of loyalty to the Government care to give expression. But the opposition was successful in that the controversial parts of the measure will now receive adequate review. That is where in this electricity business the Government are seriously to blame. Their big, novel scheme has had no proper parliamentary inquiry; and the House of Lords refuse to have, as the House of Commons are too fond of doing, important measures thrown at them at the eleventh hour of the session, with a request that they should be passed and returned to the Commons in time to get all the formalities completed before the prorogation. It is not right; and there is no justification for it. And now that the Government are out for big schemes of reconstruction, the country expects that there shall be full and careful investigation, which cannot be had by such hustle as the Government wanted the House of Lords to give this measure—a measure of a very far-reaching order, which not only concerned the electricity industry, but the whole country, for it introduces principles which may affect every other industry.

The Government and the political mind fancied they saw in this measure a means of stimulating industry by providing manufacturers with power which represents but a small percentage of works' costs. This was the declared chief aim of the Bill. But the estimate of benefit was much overdrawn, and is of diminutive importance compared with the principles that the Bill assailed and the tendencies it created. Whatever the Government may say in defence of their attitude in this matter, we have a strong preference for the views of men highly placed in industry and finance who object to the State financing an industry (save in very exceptional cases such as are illustrated by the dye industry), to plans that come perilously near to the nationalization of industry or open the road to it, and to schemes that create a large gulf between producer and consumer by separating one part of an industry from another as in this case. Such far-reaching schemes as this require very close looking into, to ascertain whether, in the national interests, their power for harm will not be greater than their power for good. The Marquis of Salisbury, who spoke last Tuesday after the Lord Chancellor had announced the intentions of the Government to suspend the controversial parts of the Bill, stated that the critics of the scheme had two objects in view: (1) To maintain private enterprise in electricity supply; and (2) to avoid throwing upon the already overburdened tax-payers of the country any greater burdens than were absolutely necessary. There are other matters that should be kept in view. Among them, whether the scheme holds out any real prospect of cheapening electricity supply, having regard to the new standard of capital cost, and whether there are not other ways through existing agencies of bringing about a real contribution to the conservation of coal. If conservation of coal is really desired, the way to realize it is not by unnecessarily increasing the tonnage of raw material consumed. If gas-works can supply coke for the purpose of steam-raising for electricity generation, it would be better that this should be done than by setting-up plant specially for the production of coke for the purpose. Perhaps we shall hear more of these things in the next session of Parliament. There are many men who desire a complete review, and not a partial one, of this coal conservation question in relation to the provision of power and heat. The Government will move unsteadily and unsafely, and with no certain good result, if it acts on partial and interested advice. The Fuel Research Board, who looked into the affairs of the gas industry, are all competent and impartial men; and their recommendations go no farther than such development as the industry is capable of within itself. No recommendations were made by them for Special Commissioners for the industry, for State aid, or for severance

and purchase by District Authorities, with direct connection, through Commissioners, with a Government Department, by which direct line control could be administered. That is the highway to nationalization, nicely prepared by a Government who reject any suggestion that nationalization is an objective. Whether it be so or not, they are smoothing the way to its realization.

When the controversial parts of the Electricity Bill come along in a new dress next session, it is to be hoped that all the large industries in the country will oppose the new principles that it introduces, and insist on the Government having a thoroughly disinterested inquiry so as to ascertain whether the scheme incorporates all the merit claimed for it, and whether results which will lead to greater conservation of our coal resources cannot be achieved another way.

Competitors' Fallacies.

THERE seems to be a deeply planted mistaken notion in the minds of some of our electrical friends regarding the position of the gas industry in relation to coal conservation. They profess that they do not believe what has been published concerning the matter. It would, however, be the easiest thing in the world, if our critics desire it, to arrange for a competent investigator acting on their behalf to witness the making of gas in the modern ways, take the registrations of the station gas-meters, and make calorimetric tests, and then follow on, at one of the places equipped for making investigations of the kind, with tests on gas-fires (taking the measurements of radiation and the temperature of the flue gases), boiling-rings, and lighting and other appliances. We can promise that the investigator would have a highly interesting time; and the result would be a report which, coming from a man of position in the electrical world, would be an invaluable testimonial for gas. We throw out the suggestion to our electrical friends; for it gets a bit tiring to read week after week the commonplaces that assumption and postulation prompt them to make as a reply to the categorical statements by men who know, and who are in a position to demonstrate the truth of their assertions.

In the paper Mr. J. G. Clark read before the London and Southern District Junior Association last Friday, he incidentally touched on the question of coal conservation, and remarked that the gas industry has everything to gain by an impartial and competent inquiry. That is what the gas industry has been asking the Government for ever since the reports of the Electric Power Committees were issued. And it was because the gas industry could get no satisfaction in response to its request that the report by Sir Dugald Clerk and Professors Smithells and Cobb was prepared and published. In the prevention of the waste of the thermal energy of coal, and in setting loose from the coal its host of valuable qualities, the gas industry has, as Mr. Clark says, done pioneer work; and it has maintained its supremacy in the use it makes of coal. For what it has done, and is doing in bringing still more value into the thermal account, the gas industry should receive full credit. The attempts that are made to deprive it of this credit will fail, as facts are not bowled-over like ninepins. Of course, one cannot judge the relative usefulness of gas and electricity solely on a heat basis, though it has predominance, as consideration of the applications of coal will show. Electricity has uses with which gas cannot compete; and *vice versâ*. The conditions of the employment of the two agents also bestow grounds for preference for the one over the other. But acknowledging this, the gas industry is quite content with its scope in the competition. We know that, in lighting, electricity has a measure of convenience and adaptability which gas does not possess—at any rate, to the same extent. On the other hand, incandescent gas lighting has lower intrinsic brilliancy for a given candle power, better quality of light, and greater economy, which will go far in maintaining its service with the masses of the people. In all heating operations, it has a range in economy of money and time which considerably out-distances electricity. In power, electricity cannot approach it for economy on commercial terms in constant running on good loads; but electricity has advantages for intermittent operation, as also for travelling machinery. The gas industry does not expect all the business; and we are equally certain the industry is not going to yield up any part of its business in which its own merits or the conditions of use impart to it demonstrable superiority.

Mr. Clark makes reference to the competition between gas and electricity for cooking—if competition it can be called. We know the experience in the National Kitchens. Electricity went into some of them with great éclat; but the accumulated experience has convinced those in charge of the National Kitchens Department (as they were told it would do) that economy, convenience, and certainty for kitchen purposes are indisputably on the side of gas. But electricians have a humorous way of talking as though the work that is done in an oven constitutes the whole range of cooking. They prate about oven efficiency, and the so-called saving of meat, as though the oven was the beginning and the end of all kitchen operations in which heat is required. A very interesting part of Mr. Clark's paper deals with the question of the saving of meat, through the employment of low temperatures, and keeping the meat in an atmosphere of steam in unventilated ovens. The same saving of meat, if it were desirable, can be effected in gas-ovens. There are now externally heated ovens in which considerable use is made of the heat of the products of combustion, by regulated circulation between the interior and exterior casings of the stove. In these ovens, precisely the same effect can be obtained (we repeat, if desirable) as in an electric-oven. But is it desirable? Mr. Clark's answer, as the result of long experience and investigation, is that it is not.

What is the primary object of cooking meat? It is not to "save" in weight. It is to make the meat fit for human consumption, and nutritious. The experience of large catering concerns, the paper tells us, is that unless meat is cooked to such an extent, and in such manner, that it loses between 18 and 24 p.ct. of its weight, it is unfit for supply to the public. The large catering establishments know best. To them the attractions in saving the weight of meat are immense; but there are still greater attractions in preventing customers going elsewhere. Cooked under the conditions existing in the electric-oven—the meat remaining in a flabby condition all the time, and with only 10 p.ct. loss of weight—the nutrients escape, and form a jelly in the dish; and to the extent of this exudation the meat is less nutritious. This is a statement from the paper. It is the result of investigation; and it is perfectly understandable to anyone who gives intelligent consideration to the matter. The exact opposite is the result of proper cooking in a gas-oven. The concentration of the nutritious juices by the additional evaporation of the water content of the meat, to an extent representing the difference between 10 and 20 p.ct. loss of weight, provides the appetizing flavour and the sapid osmazome, without which the meat would be regarded by 999 people out of every 1000 as poorly cooked. That is Mr. Clark's explanation; and it is a good one. "Osmazome" is not a term that is used in everyday locution; and therefore it may not be out of place to mention that it is a chemical name applied by Thénard to that portion of the aqueous extract of meat which is soluble in alcohol, and contains those constituents of the flesh which determine its taste and smell. Our competitors could hardly imagine that their claim as to a lower meat shrinkage, as well as the effects, would not undergo very critical examination. It has had it; and it is not to the advantage of electrical methods. Of course, it would be easy enough to run an electric-oven in such a manner that there would be greater desiccation; but then would come an increased expenditure of dearly generated electric heat, and the loss to the electricity industry of that only and much-cherished claim, or "talking point," that they have left as to meat shrinkage. It is a bait which may secure some bites until the public learn that, if they want underdone meat they can get it by the more economical gas-oven; but if they want to cook the meat so that the nutrients and the osmazome in it are retained, they must not cook it in the approved electrical mode.

The paper by Mr. Clark is one of exceptional educational value to technical-commercial men—not only in the part to which we have referred, but in those sections of it which deal with radiation and convection, industrial lighting, and the compilation of lighting data.

The L.C.C. and Meter and Stove Rents.

The Public Control Committee of the London County Council have been looking into the question of the increase in gas meter and stove rentals; and they have come to the conclusion that the Companies have a good case for making the advance. Information as to the results of the investigation appears in our "Miscellaneous News."

Distribution of Lower Grade Gas.

In an article in later columns, "Engineer" gives the results of his study of the effect upon distribution considerations of the supply of gases of different grades. Though the article is not long, there is plenty of material in it to show that responsible gas officials who are contemplating the distribution of a heavy low-grade gas must give the matters of mains, services, and pressure very careful attention. Those whose policy in the past has been to have mains of ample diameter for the work performed (and which mains are in good order to-day), will be thankful that they are prepared to take advantage as early as possible of the new conditions of working when sanctioned by Parliament.

Coal Profits Limitation.

There was no other course open to the Government but to drop the Coal (Emergency) Bill, which proposed to limit the profits of coal owners for a year to 1s. 2d. per ton. It was a measure despised by everyone, including the coal miners, who, however, did not object to it on the same ground as other people, as was shown in our editorial columns last week. But the mass of people in any way interested in industry or commerce did not disguise their animosity to this initial step in limiting profits to a flat-rate on production. There was no sense in it; and it was commonly appreciated that, if this first step was taken, it would lead to others, with the result that private enterprise and capital would be totally disheartened. Already the conditions obtaining in the coal industry, together with the uncertainty as to what was going to happen next, has had the effect of stopping capital being expended in the development of the mines. It cannot be expected that people are going to invest new capital when they do not know what is going to happen. If the Government really desire to do something to help the country to be more prosperous, they must work to make industry attractive, and not unattractive. There is a distinct feeling of gratification in the country over the withdrawal of the Bill. So far the Government have not been very happy over their new reform programme.

Price of Coal to our Allies.

It is not at all a pleasant reflection that the reduction in the price of coal for domestic purposes in this country is being partly effected by the high prices that are being charged to our allies, whose conditions are enormously worse than our own, and whose fortunes are in a tottering condition—particularly those of Italy. At the meeting of the Continental Union Gas Company last Tuesday, Colonel Le Roy Lewis spoke very feelingly on this subject. He had good cause. He knows well the conditions of France and Italy, and how important it is that they should have coal at as reasonable a price as possible, in order to help them to recuperate. Instead of that, the uncontrolled price of coal to them is helping seriously to hold them back, and is affecting exchange. It is also gravely increasing the strain of internal conditions; and where discontent is already rife, coal at the fearful price at which it is now is only assisting in producing greater irritation. Our difficulties in the home gas industry appear to be large—that is in comparison with the conditions before the war. Comparison with the circumstances related by Colonel Le Roy Lewis shows that our difficulties are not nearly so bad as those in the gas industries of Italy and France—especially the former. He referred to one town whence he had received a communication in which the price of gas is equal to 70s. per 1000 c.ft. Think of that.

Low-Temperature Carbonization Schemes.

Low-Temperature Carbonization, Ltd., which is a title that covers the history, the hopes, and the aspirations of all that is labelled "Coalite," has lately held a meeting; and the Managing-Director (Mr. H. L. Armstrong) has evinced all the optimism his predecessors in the chairs of the Coalite concerns have shown. It appears from what he says that schemes are being negotiated for the supply of gas from plants to be located in different places; but as we understand from his remarks, the negotiations have ended, or are likely to end, in only the gas being contracted for, and that the plants that will be required will have to be handled and financed by subsidiary companies. The one scheme which seems to have been definitely concluded is that for the supply of gas to the Yorkshire Electric Power Company. In this case, we do not remember that there is anything more in the scheme than that the Electric Power Company will purchase the gas for boiler firing. The gas produced per ton by the low-temperature system proper is merely 7000 c.ft. of 600 B.Th.U., which means 4,200,000 B.Th.U. per ton of coal, compared with (say) 28 or 29 million B.Th.U. in the original ton. But there are 14 cwt. of coke left per ton of coal carbonized; and we take it that what is going to happen is that this or part of it will be treated, not by low temperature, but by high temperature, in a Mond or some other form of producer, and that the resulting gas will be supplied to the Yorkshire Company's boilers. This manufacture of producer gas is no part of the low-temperature system. It is something subsidiary; and a producer gas plant can be run adjacent to steam-boilers by the owners of the boilers just as easily as they can be by the Low-Temperature Company. The sale of the gas and the coke produced by the low-temperature carbonization is very essential to success; but the Company are relying on the sale of the other products to make a large part of their revenue. These products will be subject to the vagaries of market conditions. The schemes referred to are not far advanced. If they are successful, we shall heartily congratulate the Company; but we should want to know something more about them, and make very careful investigation of them, before investing money in any subsidiary companies that are formed.

Nationalization of the Coal Mines.

The Special Trade Union Congress recently came to some decisions that are not in harmony with the trumpetings the country heard from certain camps in the labour world but a few months since. Something must have happened to produce a toning-down of the then raucous noises and grim threatenings. Are these happenings the failures of the railway and the Yorkshire coal strikes? Anyway, it is clear the moderates among the leaders in the labour world, supported by events, have won. There has been no decision yet as to the form of action that shall be taken to "compel" the Government to carry out a scheme for the nationalization of the mines. This matter, those present at the Special Congress decided, is to be deferred until after the re-assembling of Parliament in February, when the Congress will again meet. A further decision was agreement with the recommendation of the Parliamentary Committee that there should be a campaign by propaganda throughout the country in favour of the nationalization of the coal mines. We know it must have been with great reluctance that Mr. Robert Smillie has become a convert to this policy. "Direct action" was not long since more in keeping with his views.

The Late Mr. C. J. R. Humphreys.

The last issue to hand of the Buffalo "Gas Industry" contains an appreciation on behalf of the Society of Gas Lighting (signed by Messrs. J. Arnold Norcross, William A. Wood, and Samuel J. Fowler) of the late Mr. C. J. R. Humphreys, who died on June 25 last. In the course of the appreciation, the following passages occur: "Before reaching his majority, Mr. Humphreys entered the Employment of the Bayonne and Greenville Gas Light Company, Bergen Point (N.J.), serving under his brother, Mr. Alexander C. Humphreys, the Manager of the Company. While associated with this Company, he contributed some articles to the London 'JOURNAL OF GAS LIGHTING.' This resulted in his being appointed as United States Correspondent of the 'JOURNAL'—his identity not being disclosed. The familiarity displayed in these articles with United States gas affairs excited the curiosity of the gas men, especially of New York. For a long time no one suspected the young man connected with this little Suburban Company as being responsible for the articles, which showed such a grasp of American gas affairs." Mr. Humphreys, who was born in England in 1857, had an extensive connection with American gas undertakings, and was also an enthusiastic supporter of various professional organizations. He was President of the American Gas Light Association in 1896.

Temporary Increase of Charges Act.—The Ministry of Health have made Orders under the Statutory Undertakings (Temporary Increase of Charges) Act authorizing the Bolton Corporation to increase the maximum price of gas to an amount not exceeding by more than one-fourth the maximum price prescribed by section 82 of the Corporation Act of 1872; and the Shipley Urban District Council, from 5s. 5d. to 6s. 8d. per 1000 c.ft. The Ministry have received an application for an Order from the Ambleside Urban District Council.

PERSONAL.

Mr. GEORGE MITCHELL, of Falkirk, has been unanimously selected by the Blackburn Gas Committee as Manager, in succession to Mr. J. M'Lusky. There were originally 49 candidates for the position. Mr. Mitchell (now 31 years old) was formerly Chief Assistant at the Alloa Corporation Gas and Electricity Department, and subsequently Chief Assistant at Dundee. After being Manager of the Port Glasgow Gas Department, he was appointed to Falkirk last year.

A case of very long service is that of Mr. JOHN WHITEFIELD, who has been in the employ of the Newport (Mon.) Gas Company for no less than 64 years, though, being in his 78th year, his occupation is now less strenuous than it used to be. For 44 years he has been Secretary to the Gas-Works Benefit Society, which was founded by him in conjunction with the late Alderman Thomas Canning. He has filled various positions under the Company, including that of Superintendent for some years of the Crindau Works.

Mr. A. F. YATES, Chief Assistant Engineer of the Warrington Gas-Works, has been appointed Gas and Water Engineer at Goole in succession to Mr. L. W. Nuttall, who has recently been appointed Manager to the Pembroke Docks and Town Gas Company.

Mr. W. BUCKLEY, Assistant Gas Manager at Cork, already honoured by the gas staff in like manner on his departure for Tralee, has been the recipient of a handsome presentation from the commercial friends whom he had gathered round him while in Cork.

OBITUARY.

Mr. HAROLD O. TIMMINS, Gas and Water Engineer to the Hindley Urban District Council, died last Tuesday, at the age of 46 years, after having suffered for some time from heart trouble. He was the only son of the late Mr. J. Timmins, of Wigan, and was born at Leigh, where his father was at the time Gas Engineer. After serving his time at the Wigan Gas-Works, he was successively Gas Manager at Tipton and Newton-le-Willows. He had been at Hindley since 1903; and during his management very considerable extensions and improvements were carried out at the gas-works.

ELECTRICITY SUPPLY MEMORANDA.

THERE will be mixed feelings in the electricity industry over the latest decision of the Government in connection with the Electricity Supply Bill. The Government have had to bend under the weight of competent criticism and opposition to the measure in the House of Lords; and the criticism and opposition fortunately harmonize with a very extensive view in the electricity industry. It is a case of the Government forcing upon an industry a measure which does not tally with the major part of the opinion within it. The Government were attempting to rush the Bill through before the end of the session; but they were asking too much of the House of Lords in desiring their consent to a measure of this importance—a measure which the Lord Chancellor now admits is "long, complicated, and novel"—without full examination of the provisions. The Government have accepted the position; and, as the result of consultation, the Bill is to go forward without the controversial clauses in it, with the exception of one (clause 19), upon which the opposition has given way in consideration of the wholesale concession to their wishes in other respects. From what the Marquis of Salisbury said, after the Lord Chancellor had made his announcement last Tuesday as to the decision of the Government, it is quite probable that, in connection with the Bill which will be introduced early next session, embodying the excised portions of the present measure, there will be a full parliamentary inquiry before the Bill is passed into law. What, in brief, has been done in order that the measure may pass, so as to set the Electricity Commissioners to work, is to remove from the Bill: (1) All the compulsory powers for the establishment of District Electricity Boards; (2) all the compulsory powers for the acquisition of the generating stations and main transmission lines; (3) all the financial clauses in the Bill, except clause 19, which provides 20 millions sterling for the erection of emergency power stations and transmission lines. The Electricity Commissioners will almost immediately take over the electricity powers of the Board of Trade, and will be able to conduct experiments and to appoint Advisory Committees. Existing statutory undertakings may set up voluntary district authorities; but there is to be no transfer of any part of an undertaking without the consent of the owners. Any Order is to be confirmed by the Board of Trade, which we presume now means the Ministry of Transport; inasmuch as one of the final clauses says the Electricity Commissioners are to be solely responsible to the Minister of Transport, and under his direction shall carry into effect the powers and duties conferred upon them by the Act. After confirmation of Orders, there is to be approval by Parliament. The step taken by the Government is a wise one; but it means further suspense for the industry before it knows what is going to happen to it.

The Dismembered Bill.

Discourteous Electrical Criticism.

The "Electrical Review" surpasses all its previous performances in connection with coal conservation in relation to gas and electricity by publishing an article by B. L. Klemens on the "Fuel of the Future and the Gas Companies." The article is extremely discourteous to Sir Dugald Clerk; and it misrepresents his points, and makes deductions from them that are totally erroneous. B. L. Klemens has not a name that stands for so much in the scientific world as that of Sir Dugald Clerk; but in effect he accuses Sir Dugald of untruth in his figures. "It is time," says this critic, "that some statement were [*sic*] produced for the benefit of those, who, well-knowing the figures to be untrue, are without the time, or, perhaps, the special knowledge, necessary to disprove them." How anyone can know the figures to be untrue without the special knowledge to disprove them is a matter that we need not waste time in inquiring into. "It is surprising," we further read, "that one with the scientific knowledge of Sir Dugald Clerk can continually reiterate facts which have no real bearing on the case." There we have an admission that what are reiterated are "facts;" and therefore they must have a bearing on the case. Later on, there is this statement: "The whole campaign of the gas companies is one of misrepresentation and suppression of vital facts." The article is dealing with Sir Dugald Clerk's figures! Therefore, the reader cannot do otherwise than understand the writer to mean that Sir Dugald is guilty of "misrepresentation and suppression of vital facts." "Misrepresentation and suppression of vital facts" rest with B. L. Klemens.

Misrepresentations.

In the first place, he says that Sir Dugald stated that, "if all the heat used for generation, &c., were debited to gas, and the coal entirely converted into gas, leaving no residue of coke or tar, its efficiency of conversion would be 46 p.ct.; and it is on this figure that he is working." Now Sir Dugald does not say anything about the coal being "entirely" converted to gas, nor as to leaving "no residue of coke or tar." What he actually said is: "If we consider the whole of the heat used in the process (amounting to 29 p.ct.) to be debited against the principal product—coal gas—then to obtain 25 heat units in the form of gas, it is necessary to use a total of $25 + 29 = 54$ heat units of the original coal." That is a different story altogether from the representation that is made by B. L. Klemens. In other words, the whole of the heat used in producing gas, coke, tar, and the other products is in Sir Dugald's calculations debited to gas, which (the other products having a market value of considerable importance) is not fair to gas. In the comparisons, therefore, gas suffers from the whole of the manufacturing heat charge. To put it another way, in a gas-making process the efficiency of which is 71 p.ct. (there are gas-making processes in which the efficiency is much higher), the gas which represents 25 p.ct. of the heat in the coal is charged with more than its own quantity of heat (29 p.ct), while the coke and tar, with together a thermal value of 46 p.ct., go scot free! Sir Dugald made this perfectly clear; and in doing this most electricians see that he did not by any means put the best complexion on the case for gas. If coal were "entirely converted into gas, leaving no residue of coke or tar," quite a different tale would be shown. There is a simple little plant for the complete gasification of coal in actual use in certain small gas-works which produces 40,000 c.ft. of 400 B.Th.U. gas; and with other coal higher results are obtained. The 40,000 c.ft., however, will give on combustion 16,000,000 B.Th.U., or 55 p.ct of the heat value of a coal having a calorific value of 13,000 B.Th.U. per lb. Mr. Klemens states that Sir Dugald deals with a number of problematical points regarding the future manufacture of gas. We fail to see anything "problematical" in the plants that are already at work. Only recently Mr. W. F. Goodrich, of the Coal Controller's Department, stated that the gas industry during the last twelve months had, in relation to the gas produced, saved by the new methods of working, which according to the Klemens theory are "problematical," some 3¼ million tons of coal! This is something material and actually achieved. Glasgow is putting up a vertical retort plant, with steam equipment—the waste heat of the settings themselves being utilized to produce the steam required—which will deal with 1350 tons of coal per day. Manchester has considerable extensions in hand. The Gas Light and Coke Company are making large installations; Portsmouth is doing the same. Contracts are being entered into for all parts of the country; and so are contracts for water-gas plant to gasify part of the coke produced. There are works making to-day, according to the quality of the coal used and the conditions of working, gas having a potential heat value of from 9 to over 14 million B.Th.U. per ton of coal; and this latter figure by reducing the quantity of coke available for sale by only 25 p.ct. So it will be seen that Sir Dugald, in his anxiety not to make the case for gas better than what has been, and is still in a large number of cases, normal working, did not take into account the new progress which is now being applied as fast as opportunity offers—making at the same time the case for gas worse on thermal grounds by debiting it with all the heat used on the works. The electric super-stations are not here yet, nor is the 20 p.ct. efficiency; and this efficiency will only be realized under superlative loads, obtainable in certain favoured industrial areas, and not in all.

"A Little Knowledge!"

So much for the progress of the industry in producing the agent which will deliver at a reasonable price potential heat units in bulk to gas consumers. But B. L. Klemens likens this delivery to a milkman who supplies milk into a consumer's jug which is pierced with holes from the rim downwards for two-thirds of its depth—a simile that is as false as it can be. Even if it were true, it is nothing in comparison with the bulk dissipation of heat units in the generation of electricity. Mr. Klemens takes the figures for oven and boiler-ring efficiencies based on coal used at the works; and for electricity the efficiency of the appliances based on the energy delivered to them. Now if he will turn to the tests published in June last by the Fuel Department of the Leeds University, on behalf of the Gas Investigation Committee [see "JOURNAL," June 3, p. 609], he will find that, based upon the actual calorific value of the gas, the boiling-ring efficiencies obtained were 40 to 50 p.ct.; and there are makers who have now boiling-rings giving from 60 to 70 p.ct. efficiency. The newest types of gas-ovens are also considerably more efficient than the old ones. Mr. Klemens absolutely neglects the modern gas-fire which gives approximately 75 p.ct. efficiency—the radiant efficiency being about 50 p.ct., and the heat contained in the flue gases from 20 to 25 p.ct.; so that there is the balance of 25 p.ct. given off to the room by convection. Does this look at all like the simile that B. L. Klemens employs? We see from this how absurd is his statement that only 28·2 p.ct. of the heat units of the gas is used for "heating"—gas heating runs to more than use in an oven or boiling-ring. Oven use is one of the smallest uses of gas for heating. Heating purposes include room heating, water heating, boiling-ring work, industrial operations, and so on; and, as has so often been shown, at least 75 p.ct. of cooking work is done on the top plate, and only some 25 p.ct. in the oven. Talking of misrepresentation and suppression of vital facts, B. L. Klemens states that electricity can be used for "cooking and heating" purposes with an average efficiency of 90 p.ct. "Cooking" is not confined to the oven, as seen above; and the electric radiators on the market vary in their efficiency very considerably, and the efficiency is not maintained throughout their lives. He later speaks of 30,000 c.ft. of gas being generated by the "destruction" of 2 tons of coal. Two tons of coal are not destroyed in producing 30,000 c.ft. of gas. There is some 14 cwt. of solid fuel produced from each ton, 10 cwt. of which is available for sale, after making allowance for the heating requirements of the works. Just one more reference. B. L. Klemens bases his final calculations on this statement:

> Allowing the gas company to deduct the total heat value of the coke products (6,600,000 B.Th.U.) and the tar products (2,912 000 B.Th.U.), the manufacture of 30,000 c.ft. of gas has involved the total destruction of 58,240,000 B.Th.U. (the calorific value of 2 tons of coal), less the sum of the coke and tar products 9,512,000 B.Th.U.—*i.e.*, the actual net destruction of coal being equivalent to 48,728,000.

This is very badly expressed; and it is a misrepresentation. Seeing that the 2 tons of coal produce only 15,000 c.ft. per ton, it would yield for sale 10 cwt. of coke per ton, or a ton of coke from the 2 tons of coal, and as the coke would have a calorific value of (say) 12,500 B.Th.U. per lb., there is something radically wrong with B. L. Klemens' figures. It is useless discussing figures that "misrepresent and suppress vital facts." In the article there is error both in calculation and judgment. An editorial article on "Competitors' Fallacies" appears to-day, and should be read in conjunction with these comments.

Budding Activities.

"What the Electrical Development Association has Done, and Will Do" is the title of an article in "The Electrician." Mr. W. J. Beauchamp, the Director and Secretary, it appears, is developing the plans which he has laid out for himself; but the article in two or three places mentions the word "funds," and appeals for more. This indicates that the Director still feels cramped, and that, as things are, the big drum cannot be beaten in the way he would prefer. Consequently he has to take the quieter lines of activity, which, however, are not without good effect. We see from the article that about twenty pieces of literature have been issued for circulation, with the view of promoting the sales of electricity. Several paragraphs, too, have appeared in the weekly and monthly Press which, directly or indirectly, owe their origin to the Association. Information collection and distribution to the Press, Government Departments, &c., are lines of operation that have been opened-up. Government officials have been interviewed; and, in connection with the housing problem, "literature and information has [*sic*] been distributed to Government Departments, local authorities, and electric supply undertakings." Lectures and addresses have been given before various associations and societies. Limited funds notwithstanding, Mr. Beauchamp is finding a good deal of useful work at hand. Gas undertakings will take due note of his enthusiasm.

Messrs. Bale and Hardy, Ltd., of No. 39, Victoria Street, S.W., have secured the services of Mr. Matt Dunn, of Stockton-on-Tees, as sole representative for the North of England for the sale of their "Tully" carburetted hydrogen plant. Mr. Dunn's gas-works practice has been with coal specially suitable for complete gasification in the "Tully" plant. He will open offices in February at County Chambers, Middlesbrough.

RECENT DEVELOPMENTS IN COAL GASIFICATION.

By C. B. TULLY.

IN their report on the "Coal Gas and Electrical Supply Industries of the United Kingdom," to the President of the Institution of Gas Engineers, Sir Dugald Clerk and Professors Smithells and Cobb, in Part II. [pp. 20 and 21], under the head "Future Developments: Methods of Increasing Thermal Efficiency and Gas Output of Gas Undertakings," have dealt with the proposition in a very practical and able manner, which will no doubt lead to greater efforts for efficiency.

It is worthy of note that these are the very lines on which I have been working for the past fifteen years, in conjunction with the late Prof. Vivian B. Lewes. The remarkable results which are being obtained in my plant are proof of the soundness of the principles enunciated—*i.e.*, combining the gasification of coal with the production of water gas in the same plant at the same time.

Steaming retorts, either horizontal or vertical, is going back to 1824. Prof. Lewes, twelve years ago, in his book on "Gaseous and Liquid Fuels," said: "It is, and must always be, a failure." With regard to the Delwik process, Prof. Lewes and the author used Delwik's idea of blowing to complete combustion through a shallow bed of fuel, but went one better by utilizing the hot blast gases to heat-up a retort and regenerator instead of blowing it to waste as he did. If Delwik obtained 66 p.ct. efficiency, the improved plant certainly raised it to at least 75 p.ct.

The idea of mixing blue gas with coal gas from retorts has now been superseded by carbonizing the coal in a retort in conjunction with a water-gas plant. Plants are now at work on this system with an output of 50,000 to 300,000 c.ft. per day, and 500,000 c.ft. plants are in course of construction.

Without going into details, the plants will turn out gas of 500 B.Th.U.; but, as far as can be ascertained at present, 425 B.Th.U. gas will be about the most economical gas to produce, with a maximum of inerts of 15 p.ct., which can probably be reduced to 10 or 12 p.ct. The make will be about 60,000 cubic feet per ton, according to the percentage of ash present, giving 24,000,000 B.Th.U. per ton of coal. It is not the intention of the writer to go into any elaborate figures, but to place before the industry established facts, which may largely alter the course of capital and other expenditure in the future.

Any class of semi-coking coal, bastard cannel, cannel, or steam coal, irrespective of the quantity of ash, can be used in the plant; but highly bituminous coals must be used with caution. The quality of the gas produced will vary with the volatile content of the coal. The plant is so designed that the ash is of no importance, as it does not form clinker. Although it is not a refuse destructor, it will deal with coal containing up to 50 p.ct. of ash.

To instance some of the possibilities of the plant, 60,000 c.ft. of 380 B.Th.U. gas has been obtained from a mixture of 25 p.ct. of low-grade Nottingham cannel and coke—the gas containing as much as 18 p.ct. of methane, with 10·5 p.ct. of inerts.

A great advantage of the system is that the B.Th.U. value of the gas can be kept absolutely constant by simply regulating the steam pressure and water gas mixture. The higher the B.Th.U., the greater will be the cost of the gas in labour and capital. The gas of the future, and the cheapest to manufacture, will be the maximum output of coal and water gas combined by carbonizing the coal to complete destruction; and, as far as can be seen at the present time, 425 B.Th.U. is about the figure, keeping the CO_2 to 4·2 p.ct., or thereabouts.

This gas can be produced as cheap as, if not cheaper than, blue water gas, with an efficiency of at least 80 p.ct. of the coal. One of the greatest advantages of the plant is that low grade and comparatively cheap coals can be used as effectually as high-grade and expensive gas coals. In one instance, a local coal is being employed, costing 6s. per ton less than gas coal, and 10s. per ton less than is being obtained for coke.

It is impossible to foresee the effect the complete gasification of coal will have on the future of the gas industry. It will reduce the capital expenditure very considerably, will give cheaper production, will ensure the absence of retort-houses, stopped pipes, and coke-conveyors, and will reduce the coal to be handled by about 75 p.ct. It will also cut-out coke sales and breeze troubles, and this promises to convert the gas-works into a gas-generating station.

Probably this will appear to some like the dream of an idealist; but it is really the practical result of twenty years' experience of all methods of carbonizing. After all, the object of a gas-works is to make gas. If the complete gasification of coal can be achieved in one operation, it is more to the point than worrying over how gas can be reduced another penny or so per 1000 c.ft. by trying to recover some bye-products.

The war has taught us many lessons; and we have suffered many hardships. But it must be admitted that but for the war the gas industry would not have in view to-day the great future it has before it.

The writer hopes that this short account of actual development and achievement will give many tired gas managers pleasant thoughts during Christmas, when they smoke the pipe of peace, and dream of many happy and prosperous years to come.

GAS PRODUCTION IN GERMANY DURING THE WAR.

THE Central Gas Bureau in Berlin have issued a statement, compiled—up to July, 1917—from the statistics collected monthly by the Bureau from German gas undertakings, and subsequently from the returns made to the Imperial Coal Distribution Department. These latter returns, which were all made compulsorily, refer to the whole of the German gas undertakings; whereas the statistics previously collected by the Bureau dealt only with the undertakings which voluntarily made returns. The two sets of statistics overlapped for the eighteen months from January, 1916, to July, 1917; and from the ratio between the two sets for this period a correction has been applied to the earlier returns, so that the figures now reported represent approximately the total gas production in the German Empire during the years 1913 to 1917, and up to the end of the third quarter of 1918. The official collection of statistics ceased with the armistice; and no figures are yet available for any period subsequent to Sept. 30, 1918.

TABLE I.—*Gas Production in German Gas-Works.*

Millions of Cubic Feet.

Year.	1913.	1914.	1915.	1916.	1917.	1918.
January	10,792	11,128	10,294	11,026	11,572	10,306
February	8,370	8,546	8,126	9,152	9,395	8,890
March	8,154	8,702	8,320	9,135	9,784	9,347
April	7,074	7,236	7,038	7,771	8,567	8,245
May	6,544	6,936	6,766	7,140	8,584	8,133
June	6,032	6,205	6,378	6,456	7,978	7,836
July	6,201	6,523	6,731	6,826	8,441	8,286
August	6,865	6,526	7,374	7,550	8,673	8,913
September	7,918	7,049	8,225	8,452	8,747	9,793
October	9,277	8,246	9,507	10,231	9,560	—
November	10,238	9,395	10,390	11,161	9,943	—
December	11,636	10,520	11,710	12,085	10,638	—
Total for Year	99,058	96,911	85,907	106,985	111,881	—

Table I. shows the total gas production, including coke-oven gas supplied by gas undertakings, in millions of cubic feet, for each month of the years 1913 to 1918. No separate record of the coke-oven gas supplied was kept prior to 1916. In that year, coke-oven gas (included in the totals in Table I.) amounted to 8149 million c.ft., and in 1917 to 9719 million c.ft., per annum.

TABLE II.—*Percentage Increase or Decrease in Gas Production over the Corresponding Month of the Previous Year.*

Year	1913.	1914.	1915.	1916.	1917.	1918.
January	+ 5·4	+ 3·1	− 7·5	+ 7·1	+ 5·0	−10·9
February	+ 0·33	+ 2·2	− 4·9	+12·6	+ 2·7	− 5·3
March	+ 4·5	+ 6·7	− 4·4	+ 9 8	+ 7·1	− 4·5
April	+ 9·8	+ 2·3	− 3·0	+10·7	+10·3	− 3·7
May	+ 7·6	+ 6·0	− 2·4	+ 5·5	+20·2	− 5·2
June	+ 9·3	+ 2·9	+ 2·8	+ 1 2	+23·6	− 1·8
July	+ 7·5	+ 5·3	+ 3·2	+ 1·4	+23·6	− 1·9
August	+ 4·8	− 4·4	+13·0	+ 2·4	+14·9	+ 2 8
September	+ 5·6	−10·7	+16·7	+ 2·8	+ 3·5	+11·9
October	+ 4·1	−11·1	+15·3	+ 7·6	− 6·6	—
November	+ 1·5	− 9·2	+11·8	+ 7·4	−10·9	—
December	+ 4·2	− 9·3	+11·3	+ 3·2	−12·0	—

The increases and decreases in the total gas production in each month in comparison with the corresponding month of the preceding year are shown in Table II.

In comparing the figures in the tables, it should be borne in mind that the average calorific power of the gas supplied has been greatly reduced during the year under review. The figures give the total quantity, irrespective of its calorific power.

THE DISTRIBUTION OF HEAT UNITS IN GASEOUS FORM.

By "ENGINEER."

IN previous articles in the "JOURNAL," the writer has discussed the sale and manufacture of gas having regard to its thermal value. In the issue for Sept. 23, the considerations affecting the Rental Department, and the method of conversion from the present sliding-scale, were fully analyzed; and the manufacturing aspects were considered in the issue for Oct. 14. In the latter article, the question of distribution was discussed, but not at great length; and it is proposed in this contribution to study, by a few short tables, the most apparent and measurable effects resulting in the choice of gases of various grades.

The first table shows the delivery of a standard length of main, at a fixed pressure drop, and converts this delivery from bulk into gas units of 100,000 B.Th.U. per hour; the best result being credited with 100 p.ct., and the others calculated accordingly. Pole's formula is used throughout; and the calorific values and gravities are calculated from typical analyses.

Delivery per Hour of an 18-in. Main, 3600 Yards Long, Pressure Drop 2 in.

Description of Gas.	B.Th.U. per Cubic Foot.	Specific Gravity.	Delivery in C.Ft. per Hour.	Delivery in Therms per Hour.	Relative Delivery Per Cent.
Siemens gas	135	·912	45,800	61·8	16·4
Dowson gas	155	·834	47,900	74·2	19·7
Mond gas	160	·810	48,600	77·8	20·7
Blue water gas	300	·555	58,700	176·1	46·9
Carburetted water gas	580	·620	55,600	322·5	85·6
80 p.ct. coal gas 20 p.ct. B.W.G.	508	·451	65,100	330·7	88·0
60 p.ct. coal gas 40 p.ct. B.W.G.	456	·477	63,400	309·1	82·6
80 p.ct. coal gas 20 p.ct. C.W.G.	564	·464	64,200	362·1	96·5
60 p.ct. coal gas 40 p.ct. C.W.G.	568	·503	61,700	350·4	93·5
Steamed coal gas (verticals).	400	·500	61,900	247·6	65·9
Straight coal gas	560	·425	67,100	375·8	100·0

From this table, it will be observed that the water gas mixtures show-up very well; low-grade gas from steaming in verticals giving a poor result.

In the next table, two results have been combined, to avoid repetition. Column 1 gives the same descriptions of gas as appeared in the first table. Column 2 gives the necessary pressure drop in tenths-of-an-inch of water to ensure a delivery of 500 therms per hour through an 18-in. main 3600 yards long. Column 3 gives the theoretical size of main required to deliver 500 therms per hour, with a fixed pressure drop of 35-10ths, length 3600 yards, as before. Column 4 gives the cost of such mains per mile at current prices; odd sizes being calculated by differential proportion. The cost would be a little less in country roads.

Description of Gas.	Pressure Drop to Deliver 500 Therms per Hour. 18in. Main.	Size of Main with Fixed Pressure Drop.	Cost of Main per Mile.
		Inches.	£
Siemens gas	1308 tenths	37	20,000
Dowson gas	907 ,,	34	17,700
Mond gas	827 ,,	33	17,000
Blue water gas	161 ,,	24	9,250
Carburetted water gas	48 ,,	19·1	6,900
80 p.ct. coal gas 20 p.ct. B.W.G.	46 ,,	18·9	6,830
60 p.ct. coal gas 40 p.ct. B.W.G.	52 ,,	19 3	6,970
80 p.ct. coal gas 20 p.ct. C.W.G.	38 ,,	18·3	6,600
60 p.ct. coal gas 40 p.ct. C.W.G.	41 ,,	18·5	6,650
Steamed coal gas (verticals)	81 ,,	21	7,550
Straight coal gas	35 ,,	18	6,500

The above table is instructive in two points of detail. Column 2 emphasizes the large increases in pressure necessary to ensure the extra delivery over that possible by normal pressures; and the third column shows the very rapid rate of delivery compared with the increase in diameter. It further demonstrates the wisdom of those whose policy in the past has been to have all mains "large enough."

To return to the first table, it is clear that responsible officials who are contemplating the distribution of a heavy low-grade gas must give the matter of mains, services, and pressure their careful consideration. The table shows the marked effect of gas made by steaming in verticals; and the difference of delivery becomes considerable when dealing with a large proportion of blue water gas. A great deal depends on the sizes of the existing mains compared with the work they are called upon to do. Another factor will be the number and size of the trunk feeding mains as compared with service mains. If a good system of trunk mains is in existence, well laid, then liberties can be taken in the matter of pressure, which in the absence of such mains would not be desirable.

When high pressures are used in trunk mains, efficient governors must be built in the ground at places where they feed the service mains; and if money is spent judiciously on such a system, excellent control can be maintained. There is also the possibility of putting high pressures into the service mains and governors into the houses, or in common services giving a supply to groups of houses. This is an expensive matter to consider in a district already built-up, but is worth looking at when opening-up a new area. The saving in main-laying costs by the adoption of high pressures, may be very considerable at to-day's prices, and give a handsome profit, even after paying for service governors. In considering this, however, the system must be a real high-pressure one, running into pounds per square inch; otherwise the expense of governors will be more than the saving on mains. It should also be remembered that the governor will be more efficient with a big pressure difference than with a small one.

Before closing this final article, the writer would like to point out that many of the features of the Beilby report have been advocated by Mr. H. E. Jones for a number of years; and the following are his opening words in a paper read before the Institution of Gas Engineers nearly eighteen years ago:

> What is it to be? In other words, what is the gas of the future to be? Clearly a calorific gas—and the cheapest in the truest

sense of what will be the most generally useful to the consumers, having regard to the cost of its production and distribution.

In this paper, Mr. Jones went on to advocate the removal of illuminating values entirely, and to get rid of the necessity of working-up, at unnecessary expense, to a high standard of quality and purity. It must be a source of considerable satisfaction to him to read the report of the Fuel Research Board.

If the writer may venture to prophesy, the immediate future will not bring many rapid changes in the quality of gas made. Many undertakings will make no change whatever, except those required by the report in the matter of pressure and inerts. In any case, the changes will be much slower and less revolutionary than has been supposed by many of those who have considered the matter. In special cases, we may well look into the matter of duplicate supply systems of low-grade gas, with few customers or services, and at high pressures. Further developments may take place in the complete gasification of coal in one operation; but this is fraught with many pitfalls, and is not so attractive as it appears on first sight, or by the mere financial aspect of "net cost of coals per therm produced." If this were the only consideration, figures of recent results which have been seen by the writer would place the issue beyond doubt.

CRUDE AMMONIACAL LIQUOR AS A STIMULANT FOR AGRICULTURAL PURPOSES AND GARDENING.

By ALFRED W. EDWARDS, of Copenhagen.

THE Danish Gas Company have for many years endeavoured to introduce the use of crude ammoniacal liquor as a stimulant for agricultural purposes and for gardening, but with very poor results until a florist at one of our towns was persuaded to make a trial.

The matter was taken up in the proper way; and as the time is now at hand when the liquor should be used, and as it will no doubt interest readers of the "JOURNAL" to learn what can be obtained when the liquor is properly used, I am enclosing a translation of the florist's statement of his experiments over a number of years.

AMMONIACAL LIQUOR AS MANURE.

Practical Experiments Made with Crude Ammoniacal Liquor.

By F. NIELSEN, Florist.

DURING the last fifteen years, the following experiments have been made with ammoniacal liquor. At first, they were made in a faltering, undecided manner; but, as the results gradually became manifest, the practice of using it became more regular, and it is now used for the cultivation of the ground for scientific gardening and agriculture.

I made my first experiment with early cabbage (Wakefield). The ammoniacal liquor was diluted with three parts of water, and the cabbage was treated with it only between the rows on half of the area, before the earthing of the plants took place. The result soon appeared, and was most obvious. Though the whole of the area had been abundantly treated with good stable manure, and the soil was of excellent quality, the plot of ground (with the cabbage) which had been treated with the ammoniacal liquor showed a deeper green colour. After the lapse of fortnight, the leaves grew more robust, and proved later on to be proof against the attacks of parasites.

The produce was one-third greater than that obtained from the other part of the area; and the quality was far superior. My mind, of course, now became bent on achieving greater things. The ammoniacal liquor was used everywhere, and for everything—not, however, with the same success. In the course of years, I gained much practical knowledge, for some of which I had to pay dearly. Ammoniacal liquor used (say) in tomato and chrysanthemum hot-houses kills everything, merely by its fumes. Even moderately large animals, not to mention insects, suffer death for their forward boldness. However, this was a new proof of the intrinsic value of ammoniacal liquor—its aptness for disinfecting empty hot-houses, and fruit-trees, fruit-bearing shrubs, roses, strawberries, hedges, &c., in fact, for the very soil itself, for which it was excellent manure at the same time, and in this way of twofold value.

The next winter the ammoniacal liquor was again used. It was poured over everything; and the results exceeded, if possible, my expectations. The fruit trees and bushes, roses, and hedges were quite clean and smooth as wax-candles, free from moss, fuciculadium, and monillia. Since then there have been no signs of the weevil, and not a single fruit tree (there are about a hundred) has been disfigured by excrescences. A peculiar freshness and fulness was seen everywhere. All this I had expected; but I must confess that I felt some anxiety about the strawberries. They were watered with the ammoniacal liquor about the middle of February; and at the beginning of March everything had disappeared—not a leaf, not a stem indicated where the strawberry ground was. Though the proceeds from these strawberries were not of special importance for my subsistence, and the plants were affected here and there with strawberry-mites, it had not been my intention to kill the plants.

Well, time passed on, spring came, and with it the strawberry plants with fine, dark leaves and with thick, robust fruit stalks, which I had scarcely dared to expect. The strawberry harvest of that year is still a record. We simply gathered the strawberries, and (best of all) the strawberry mite had disappeared for ever.

The ammoniacal liquor was used for turnips, potatoes, corn, grass—to say nothing of all sorts of vegetables; but experience showed over and over again that it is quite devoid of phosphoric acid, and must not be used direct for the seed sown in spring. On the other hand, it can decidedly be proved that the effect continues to a considerable degree—even for five years after the soil was watered. Consequently, there must be something else in the ammoniacal liquor besides the known 1 to 2 p.ct. of nitrogen.

I may give the following short (but perfectly reliable) directions for the use of ammoniacal liquor as a manure and a disinfectant. My experience is founded on careful, thorough, and comprehensive experiments, and on the extensive practical use made of the ammoniacal liquor at very high prices. Fruit trees, fruit bushes, rhubarb, perennial plants, roses, defoliating hedges, &c., are watered or sprinkled thoroughly in the months of November, December, January, and until the middle of February, not later, as the fruit buds—especially those of the wall-fruit—begin to loosen their bracts, and might easily be injured by it. Strawberries are to be watered (with a large rose) in January and February—on no account in March.

All unused plots in which cabbage, potatoes, trees, bushes, strawberries, rhubarb, turnips, and any other sort of vegetables are to be planted, may with unfailing result and without the smallest loss of manurial value be watered with ammoniacal liquor all the winter and spring, till three weeks before the planting and eight days before the sowing of the seed takes place.

In sprinkling or watering with ammoniacal liquor great care must be taken not to touch the evergreen plants, as irreparable harm will thereby be done.

Asparagus may with the best of results be watered with the ammoniacal liquor when the cutting is over—say at the end of June. It may, however, also be used during the first winter months.

Grass-land can be watered with the liquor (greatly diluted) preferably in January or February—not later.

For winter-seed (rye and wheat, but especially wheat), the ammoniacal liquor must be used as early as possible before the sowing takes place; and by its after-effect in the following summer, it will prove to be of inestimable value.

The ammoniacal liquor must not, as mentioned before, be used direct for the seed sown in spring. But barley grown after turnips, in a field watered for the latter with ammoniacal liquor, proved to be of great value; and the effect appeared in the two or three following crops of corn.

In hot-houses, it must be used very carefully. While the watering takes place and during the ensuing two or three days there must be no plants in the house. After the watering, the house should be closed completely for a few days. The result attained will not only be that the soil is manured and disinfected, but that the hot-house will be thoroughly cleared of parasites, and a good result on transplanting tomatoes and chrysanthemums may be reckoned upon.

The soil for the flower-pots for the chrysanthemums may with a good result be watered with ammoniacal liquor. At the same time it must not be forgotten to use a considerable quantity of lime.

One cannot emphasize too much the need for lime wherever one wishes to obtain good results from the soil. By means of ammoniacal liquor alone, a plant can be produced large and robust as no other means can do it; but it cannot be complete without abundant lime (phosphoric acid and potash). The plant is larger and requires more starch.

The ammoniacal liquor is now made practical use of to the very last drop in this part of the country; but millions of drops are lost all over Denmark by not being used. And yet we want every grain of manure so badly, especially at present when none (or very little) is to be had from abroad. But even if we could get it, are we allowed to; and is it practical to throw our own articles of value overboard? I think not.

NOTE.—The ammoniacal liquor from the Assens Gas-Works contains from 0·80 to 1 p.ct. of ammonia. When the ammoniacal liquor contains a greater quantity of ammonia, the proportion may have to be altered.

A Calculation of the Work Done by Gas.

Mr. Donald M'Donald, of the Louisville Gas and Electric Company, is quoted as having shown in a graphic manner the extent of the work that is done by his Company. Speaking about the "servant that he knows," he said: She does all the cooking, washing, ironing, and cleaning for a family of five. She brings in the fuel, lights the fire, cleans and attends to the lamps, and when she is not otherwise busy turns the machine on which the bread-winner of the family makes his living. She never complains about the amount of her work; on the contrary, she is constantly saying that she would like to have more to do. She does not carry a basket home at night. Her wages are $1 a week; and she is perfectly contented with them. She works for the Average Family, who live on Every Street, in Louisville; and her name is the Louisville Gas and Electric Company. She is what is called a Public Servant. From a careful calculation, he finds that it would require 250,000 able and willing slaves to do the work in his city which is done by the Gas Company. In order to be as economical as the present service, these slaves would have to work without wages, to wear no clothes, and to satisfy their appetities with $1 worth of food each week. Of course, servants should always display humility. They should never grumble about the amount of work they have to do; but when the servant is willing and anxious to do more work, no one should grudge her the privilege of bragging about the amount of work that she is already doing.

The Vertical Gas-Retort Syndicate, Ltd., have arranged with the patentees (Messrs. J. W. Gibson and R. L. Wyman) to take up the exploitation of the "Simplex" water-gas plant, an article on which, by Mr. Gibson, appeared in our issue of the 9th inst.

SOME TOPICS FOR DISCUSSION.

By J. G. CLARK.

[A Paper presented to the London and Southern District Junior Gas Association, Dec. 19.]

A little while back our Hon. Secretary reminded me of my promise to submit a paper for discussion this evening. I immediately turned my attention to find a suitable subject; and upon looking through my notebook, it occurred to me that some remarks on a few matters that appeared there might be suitable.

A point that must have made a great impression upon all of us is the almost bewildering rapidity with which events succeed each other at the present time. "Impossibilities" are being done; and he who would keep abreast of the times must study with the utmost attention not only his own work but also that of others. This imposes upon us all the necessity, among other things, of intensive reading—intensive out of all proportion to what was considered sufficient a few years ago. It will be appropriate to remind ourselves that there is an art in reading. Experience has no doubt taught us all that "as few excel in reading justly as in writing well."

Elizabeth Barrett Browning, in her clever "Essay on Mind," gave some good advice on reading. In speaking of writers, she advised that "when on deep research the work you find a too obstrusive transcript of his mind; when you perceive a fact too highly wrought which kindly seems to prove a favourite thought; or some opposing truth traced briefly out with hand of careless speed—then turn to doubt; for private feeling like a taper glows and here a light and there a shadow throws. . . . Of such delusions let the mind take heed, and learn to think or wisely cease to read."

It is true the advice was intended for students of history, but it is no less useful to the technical reader.

ELECTRICITY *versus* GAS.

These two commodities, apart from the use of the raw fuel, form the principal vehicles by which the energy of our coal resources are applied for the comfort and well-being of the population in their homes, and their relative merits have been the subject of searching inquiries during the past few years. It has to me always seemed unfortunate, for the full and legitimate development of electricity supply, that unsound ideas should be promoted and encouraged as to the infinite possibilities of electrical energy. Achievements for it bordering on the miraculous have been forecasted as though nothing else were of any importance. These assertions of the prospective pre-eminence of electricity are by no means confined to recent years. On looking through some old papers a little while back, I found a report of a lecture given in April, 1883, on "Power Transmission," by Prof. Osborne Reynolds. In the opening paragraph of his lecture he said: "The fact is that we have heard so much about electricity that I began to think it was time to recall attention to the fact that there are other means of performing mechanical operations." This was said 36 years ago by one who was among the foremost in the scientific application and transmission of energy; and the "fed up" tone of his remarks seems singularly applicable at the present time.

Owing to the not very distant depletion of available coal in this country, and to the reduced rate of output from the mines, attention has been focussed upon the operating efficiencies of the great coal-consuming industries; and to anyone even distantly familiar with these industries, it seems clear that the gas industry has everything to gain from impartial and competent inquiry. The problem of preventing waste of energy, which in the long run means the prevention of waste of heat, is a very attractive one, and, so far as can be seen, the introduction of gaseous fuel for lighting, heating, cooking, and power marked the earliest serious attempt to prevent this waste. The historian of the future, when reviewing the ghastly extravagance of fuel by his contemporaries' forefathers, may give a little credit to the gas industry as the successful pioneer of sane economy of so much of our national wealth in coal. It is true that Rumford and others investigated problems of heat economy before gaseous fuel was developed, but evidently from the point of view of heat insulation rather than that of efficiency of combustion. Not only was the gas industry the pioneer, but it stands pre-eminent at the present time as the channel whereby the nation's coal can be, in the majority of cases, most efficiently applied to domestic and industrial work.

It is, of course, true that simple heat economy is not always the criterion. To take an extreme case, one would not judge the transmission of electrical energy through the Atlantic cables from a thermal point of view. The familiar and useful electric torch consumes expensive energy. If the cost of the dry battery is charged against the output of light from the lamp, it will be found that the electrical energy so obtained costs several pounds per B.Th.U.; and it has been estimated that the tiny currents that operate the delicate receivers at the terminals of the Atlantic cable cost something like a billion pounds per horse-power-hour. These are extreme cases; but the same remarks apply, in a lesser degree, in a sort of descending order until something like common ground is reached upon which the two great industries—gas and electricity—can compete on very nearly equal terms to the benefit of each other.

A clever mathematician will some day tell us the mechanical efficiency of power transmission by Hertzian waves or the thermal efficiency of Röntgen rays. They are very low. Gas can do none of these things; but it is more than likely that the analytical and constructive carbonizing processes will be the origin of them all. The gas industry can, however, easily afford, as it always desires, to be fair to electricity, and allow that in some cases it permits of mechanical and thermal power being applied in a manner that is not only inconvenient, but sometimes is not even possible by other means. Let us hope, however, that wise counsel will prevail over the idea that electricity ought to be used for operations which can be performed by gas with a consumption of from one-half to one-fourth of the quantity of coal, to say nothing of the lower financial cost.

It was my privilege not long ago to be responsible on the gas side for a critical and scientific comparison of gas and electricity for the roasting of meat on a large scale. The details have already had publicity and need no repetition here; but a brief review of some of the lessons to be derived therefrom might be interesting. Regarded from the thermal point of view, gas is, of course, far and away more efficient than electricity; but some respect must be given to the dietetic aspect of the question, for which the electrical people have made such large claims. Real saving of meat is even more important than saving of heat. The science of dietetics is, I should think, the oldest and most important of all sciences, and the cook, whether the most expert chef or the humbler housewife, the oldest and greatest of all our scientists.

Our friends the electricians have found a good deal of fascination in the matter of loss of weight when meat is cooked in various ways; but to anyone acquainted with the subject, the information revealed by the many experiments that have been made is not new. Paper bag and casserole cooking, and cooking in certain types of gas oven, give results similar to those obtained by the electrical methods which cook meat with a loss of something less than 10 p.ct. Is this kind of cooking necessary or desirable? It is purely a question of desiccation. The large catering concerns that depend upon public patronage for their success will tell you that unless meat is cooked to such an extent and in such a manner that it loses between 18 and 24 p.ct. of its weight it is unfit for supply to the public. The difference between a loss of 10 p.ct. and (say) 20 p.ct., where hundreds of pounds of meat are cooked has great attractions, especially at the present day, and would be welcomed with open arms were these catering firms unaware of the fact that to serve meat so cooked would compel their customers to go elsewhere. The concentration of the nutritious juices by the additional desiccation represented by the difference between a loss of 10 and 20 p.ct. provides the appetising flavour and the sapid osmazome, without which the meat would be regarded by 999 people out of 1000 as poorly cooked.

I mention these points because I have found a tendency among some gas people to look upon a loss of something less than 10 p.ct. as an ideal to aim for in gas cooking; but I feel sure that in most cases this would be a mistake from the dietetic standpoint. The few people who prefer the meat cooked with only a 10 p.ct. loss can be very easily catered for by methods well known to the gas engineer and the gas salesman; or if these people are sufficiently wealthy, they can use electricity.

There is another aspect of the question. When meat is cooked by the "10 p.ct. method," the nutrients, being in the soluble form, escape freely and form a jelly in the dish in which the exuded products are collected. This means evidently that although the "10 p.ct." cooked joint weighs more when cooked than the more desiccated "20 p.ct." one, it is really less nutritious to the extent represented by the nutrients that have been exuded. In the one case (the 20 p.ct.) the water has been removed mainly by evaporation; the soluble nutrients being left behind to give flavour and food value to the joint. In the case of the lower desiccation (10 p.ct.), the loss of water is, I believe, due mainly to leakage in the liquid form, accompanied by the soluble nutrients that should form so important a constituent of the finished product.

Some might regard this simple business of cooking as not worthy of so much attention; but it is, I think, too important to overlook. Count Rumford spent a large part of his life studying cooking; and the fact that he presented many cooking appliances to the Royal Institution (which he founded) seems to suggest that he regarded it as a matter worthy of inclusion among the sciences which come within the purview of the Institution. Indeed, it is more worthy than this; for if the science of dietetics goes wrong, everything else would soon follow it. The regulation of heat is a factor of obviously great importance in cooking, and indeed in all forms of heating; and here gas is at an immense advantage. The electrical equivalent of a simple gas-tap or gas-regulator is at present a practical impossibility.

These few remarks have been strictly confined to oven cooking, because it is here that electricity as a cooking agent approaches most nearly to gas. It is clear that for other operations, such as boiling, grilling, &c., it will not bear the slightest examination, and needs no further consideration here.

RADIATION *versus* CONVECTION.

The relative merits of these two methods of heating have been discussed very fully from time to time, and there does not seem much more to be said about them. I have a record of some experiments made a few years ago which are interesting in so far as they bear upon points which the gas solicitor, as our American friends call him, sometimes has to discuss with his customers. Experience compels us to the conclusion that sometimes one of

these methods of heat conveyance is to be preferred to the other. A distinction between the two methods is illustrated by the following observations. Convection, if undisturbed by any other movement in the air, proceeds by gravity in an upward direction: and one would naturally expect to find the temperature higher in the upper parts of a room than in the lower. The diagrams show the result of some simple observations of the temperature at two different levels in a room for the two systems of conveying heat—namely, by radiation and by convection. [See footnotes to diagrams.] The room used for the experiments can be regarded as an ordinary dwelling room with doors closed and windows slightly open at the top. Notice how much the upper temperature exceeded the lower in fig. 1, compared with fig. 2. The thermometers were of the ordinary mercurial type, with bulbs slightly blackened, so as to absorb radiation. They were placed so that the bulbs were 2 ft. and 9 ft. above the level of the floor.

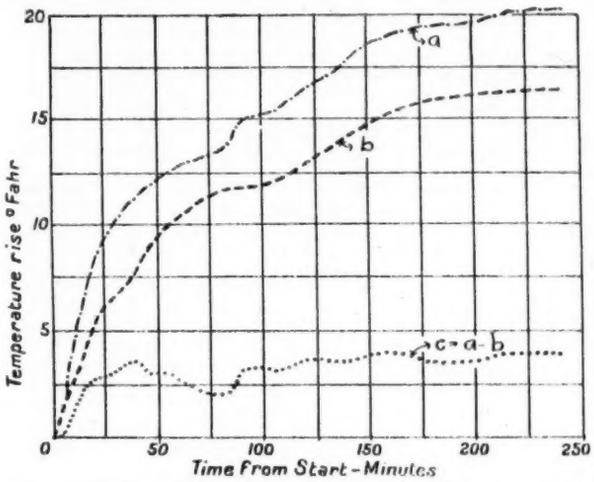


Fig. 1.—The data for this diagram were obtained with a stove having a radiant efficiency of only 10 p.ct., but yielding practically 60 p.ct. of the heat of the gas as convection.

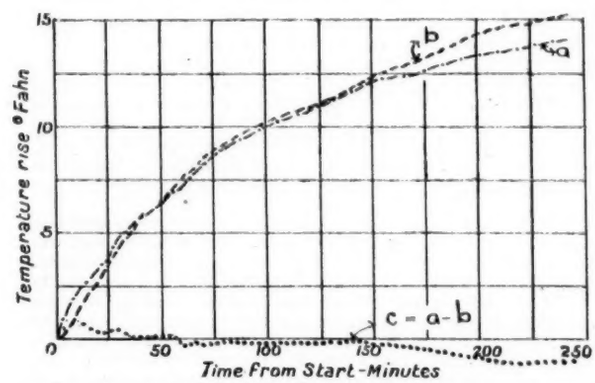


Fig. 2.—The data for this diagram were obtained with a stove having a radiant efficiency of 48 p.ct., only about 25 p.ct. of the heat of the gas being given up in the form of convection.

If the air in the room when heated mainly by convection (fig. 1) had been disturbed by frequent opening and closing of the door as in a shop, or by moving machinery as in a factory, the turbulance created would have had the effect of causing the upper and lower layers of air to mix, and the difference of temperature at the two levels would tend to vanish. The observations confirm a conclusion which, of course, has been accepted for many years regarding the distinction between the two methods of warming—namely, that convection is best suited for places where there is a fair amount of air movement to help in the distribution of the heat. It will also be observed in the case of the convector (fig. 1.) that, though the actual temperature at the two levels was continually rising, the difference after a rapid rise and a subsequent less fall assumed a fairly steady value. This, I presume, was due to the establishment after a while of a fairly steady rate of air change through the exits in the upper level of the room. In the case of heating by radiation (fig. 2), a small difference in the temperature at the two levels was created at first; but this rapidly became a vanishing, and ultimately a negative, quantity. Presumably this was due to the fact that the radiation was more intense at the lower levels, as is usual with gas-fires, and also had a certain "soaking effect" upon the floor and furniture in the room. This distinction between radiation and convection is, of course, based upon purely physical measurements; but in so far as it confirms the well-known physiological superiority of radiation for the heating of closed interiors, the observations are, I think, not without interest.

Industrial Lighting.

Four or five years ago, during a survey of the artificial lighting conditions in factories and workshops in the London area, some interesting and curious things came to my notice regarding the prejudice that sometimes exists against improvements in lighting. I suppose all of us have at some time or other come across people who, either as individuals or as a body, have a natural aversion to any change in their environment. They might almost be called the inerts of the community. The war was a great reformer in these things; and let it be hoped that enough has been learned to ensure that prejudice shall no longer hinder the adoption of more scientific and less wasteful use of our national resources.

In the survey already alluded to, I recall finding quite a number of workpeople who were content with, and even enthusiastic in the use of, the flat-flame burner. Let me give two instances. In one place, a fairly large boot factory, the "lasters" were working under the ruddy rays of both flat-flame and argand burners. They were evidently delighted with the ease with which they could move the double arm brackets so as to get the light "right on the work" as they said. So near were the flames to the work that an observer might very well have been pardoned for asking whether the gas lights were to illuminate the boots or to burn them. It was only by great pressure that the workmen would agree to the "new fangled idea," as they called it, being tried. A single incandescent factory lighting unit was fixed up for one of the workmen; the others being left with their old friends the flat-flames. I felt a certain apprehension that the new unit would be ill-used. Things, however, were not so bad as this; and when the gas company's representative called a few days later, all the workmen were enthusiastically in favour of the new system. It was the beginning of the re-equipment of the factory, and, of course, a substantial saving in gas used for lighting. Some illumination measurements were made on the working surfaces before and after the change. They were as follows: With flat-flames, 1·6 foot-candles; with incandescent units, 4·7 foot-candles.

These figures do not tell the whole story. The flat-flames were generally so near to the work as to dazzle the eyes of the workmen; whereas the incandescent units were well out of the normal range of vision. Again, the illumination at various parts of the work-bench, due to the flat-flames, varied from 0·9 to 2·5 foot-candles—that is, a ratio between maximum and minimum of 2·8. The variation with the incandescent units was 6 to 9·7 foot-candles—that is, a ratio of only 1·6. The new installation therefore gave four and a half times the illumination of the old, was much more uniform, and saved about 50 p.ct. of the gas used for lighting.

In another large workshop, where skilled men were engaged in fine metal work—such as silver cases of various kinds and silver ornaments for brushes, hand mirrors, &c.—flat-flame burners on double-arm brackets were used. The first opposition came from the manager. He found it difficult to believe that gas officials were anxious to interest him in a scheme that would halve his gas lighting account and give him more light. Having banished his suspicions—a fairly easy matter—the next thing was to deal with the workmen; the manager being disinclined to do anything that did not meet with their approval. A long conversation with the foreman revealed the fact that the men honestly believed that flat-flame burners were best for their particular work. They attached great importance to the movability of the double-arm brackets. In the end, however, the foreman and one of the workmen agreed that one incandescent fitting should be installed. As movability was insisted upon, a special pendant was made up. On calling a few days later, I found the hostility to the improvement had not completely disappeared, but had distinctly softened. Although at first the workman had made use of the movability of the inverted burner that was provided, he had ultimately found for it a position which suited all his requirements; and the need for movability vanished. A careful note was made of the position he had selected; and when the whole equipment was dealt with later, this information was very useful. It is in my experience very seldom that movability of the lighting units is really necessary in industrial work, provided attention is given to their disposition and shading. Needless to say, a carefully selected shade was provided with the incandescent burners, so that all glare effects were eliminated.

The flat-flame burners that had been used were rather large ones, each consuming between 6 and 7 c.ft. of gas per hour. They were generally so near to the work as to give an illumination of 2·3 to 5·3 foot-candles at the working point; but the dazzle due to this nearness of the light to the eye obviously limited the dexterity of the men. It was a significant point in this instance that the men were paid by the job; but by the operation of trade rules they were debarred from doing the job in less than a specified time. It was clear that many of the men were capable of turning out one-and-a-half to twice as much work as they actually did. The argument that better lighting enabled more work to be done did not therefore in this instance make a strong appeal; and the pressing of the fact that a substantial saving of gas would result from the change seemed to estrange the manager from his workmen—the latter evidently thinking that the mere cutting of expenses was uppermost in the manager's mind. Nevertheless, they were all ultimately converted to the change; the improved brightness and cheerfulness of the incandescent installation being, I believe, the principal factor in bringing about the alteration in this particular case.

These experiences only serve to emphasize what, in my view, is an important point in arranging lighting equipment for factories

—namely, that some preliminary trials with temporarily arranged lamps are nearly always repaid by the exact knowledge gained. This knowledge can then be applied to the whole installation, and any new ones of the same kind that come up for attention afterwards can be tackled with the practical certainty of giving satisfaction. The variety of conditions that have to be contended with are generally far too complex to be dealt with off-hand with sufficient certainty. Having satisfied a given set of conditions, the advice of Captain Cuttle can be applied with advantage, so as to avoid the necessity of going through the same experimental process again.

I do not pretend to be a salesman; but it does seem to me that, unless a salesman is able and willing to study the special requirements of his clients in such a complex business as industrial lighting, the mere taking of orders by him is not in the long run likely to be conducive to the best interests of gas. Now that industrial lighting is assuming—indeed, has already assumed—the importance it deserves, the gas lighting engineer may expect to be asked for more precise data regarding equipment. Technical journals, textbooks, and handbooks are consulted by works managers; and in them they find advice as to the number of foot-candles of illumination that ought to be provided for a given class of work, and other information of a similar character. This is all to the good from every point of view. Makers of gas lighting appliances will no doubt be prepared to give reliable data regarding their appliances, so that the results realized when their lamps are installed will be a near approximation to the forecast.

COMPUTATION OF LIGHTING-DATA.

It occurred to me that a few points regarding the computation of gas lighting data might be useful. Industrial lighting comprises such a variety of conditions and peculiar requirements that it will be advisable on the present occasion to confine attention to the aspect known as general lighting. In doing so, it will probably be better to regard the subject from a practical point of view. So I trust that those of you who are purists in the nomenclature of lighting and illumination will pardon any slight departures from it that they may find in the remarks that follow.

It has been my practice for some time past to take advantage of any opportunity that comes to hand of determining the amount of light usefully employed in relation to the amount of energy expended. The energy expended can be expressed by the quantity of gas consumed to produce the light, and the amount of light can be stated in terms of:

$$\text{Area lighted in square feet} \times \text{Average illumination in foot-candles} \times \text{Time in hours,}$$

the result being stated in lumen-hours—one lumen-hour being numerically equal to the amount of light received by one square foot of surface when illuminated to the degree of one foot-candle for one hour. A thousand square feet illuminated to (say) 3·5 foot-candles would be described as receiving $1000 \times 3{\cdot}5 = 3500$ lumens. This provides a ready and simple means of recording the performance of a lighting installation, the ratio:

$$\frac{\text{Square foot illuminated} \times \text{Average foot-candles}}{\text{Gas consumed per hour,}}$$

showing at once the number of lumens utilized upon the working surface.

Naturally, the ratio varies with conditions. Two illustrations will show what I mean. Assume we have two workshops similar in every respect; the walls being limewashed to a high degree of whiteness, so as to act as very nearly ideal reflecting surfaces. Similar lamps similarly disposed are also assumed; the only difference being that suitably proportioned enamelled steel reflecting shades are used in one case, and only clear glass globes in the other. It may be taken that the gas consumption in the lamps and the total emission of light from them is the same in each instance. If the illumination on the floor or some surface parallel to the floor is measured, the results obtained in each workshop will not be greatly different; and if the gas is at low pressure, something in the neighbourhood of 100 lumens per cubic foot of gas per hour will be the result. I have found freshly whitewashed walls with a reflecting power of 90 p.ct. of that of a practically perfect white surface. It deteriorates, however, owing to dust, and may decline in reflecting power to only 20 p.ct. of a perfectly white surface, and in bad cases, much lower. This decline in reflecting power will, of course, have an adverse effect upon the illumination over the areas of the two workshops under discussion; and while this may be serious when the unshaded lamps are used, it will be practically negligible in the other case. This comparative independence of the condition of the walls, where properly proportioned shades are used, arises from the fact that the shades, and not the walls, act as the reflecting surfaces; and, whereas the maintenance of the whiteness of the walls is a thing not to be lightly undertaken, the maintenance of the reflecting power of the shades is comparatively an easy matter. This leads to the conclusion that, whereas 100 lumen-hours per cubic foot of gas can be relied upon with low-pressure direct-lighting by inverted burners properly shaded, not more than about 70 can be safely relied upon with unshaded burners, unless more than ordinary attention is given to maintain the whiteness of the walls.

By determining and summarizing observations of this kind for a variety of conditions, some very useful practical data might be compiled. The following table will, I hope, form a nucleus which might be supplemented with data obtained by other observers.

	Description of Walls.	Description of Lighting.	Lumens Utilized upon Working Surfaces per c.ft. of Gas per Hour.	Remarks.
1.	Light distemper, C.R. 45 p.ct.	Low pressure inverted direct lighting. Well shaded.	110	Partly glazed roof.
2.	Light distemper but badly soiled, C.R. 15 p.ct.	Low pressure inverted direct lighting. Not well shaded.	74	
3.	Light distemper, C.R. 45 p.ct.	Low pressure inverted semi-indirect.	66	Roof partly glazed.
4.	Lower part dark brown, C.R. 5 p.ct. Upper part lighter, C.R. 30 p.ct.	Large low pressure inverted units. Direct lighting. Fairly well shaded.	102	
5.	Light coloured walls, C.R. 70 p.ct. Ceiling very white.	Low pressure inverted semi-indirect lighting.	72	
6.	Wood workshop, light distempered walls, C.R. 50 p.ct.	Inverted low pressure direct lighting. Well shaded.	118	
7.	Stone coloured distemper, C.R. 40 p.ct.	Inverted low pressure direct lighting. Well shaded.	100	
8.	Green distemper, C.R. 50 p.ct.	Upright low pressure direct lighting. Well shaded.	75	
9.	Dirty whitewash, C.R. 21 p.ct.	Inverted low pressure direct lighting. Well shaded	105	

C.R. = Coefficient of Reflection.

A comparison of Nos. 1 and 9 illustrates how small is the influence of the walls provided the lighting units are well shaded. No. 2 shows the adverse effect of dirty walls if good reflecting shades are not used.

Nos. 3 and 5 represent semi-indirect installations. This system is by its nature less efficient than the direct method. Under suitable conditions, low-pressure inverted burners may be relied upon to give about 70 lumens per cubic foot of gas per hour when used by semi-indirect methods. The partly glazed roof of No. 3 no doubt has an adverse effect upon the result.

No. 8 is interesting as showing what low-pressure upright burners will do under suitable conditions of shading.

The application of such data is very simple. Assume an interior of some kind or other has to be lighted to a certain degree—say, 5000 sq. ft. of floor area with an average illumination of 4 foot-candles. This means that $5000 \times 4 = 20{,}000$ lumens have to be directed to the floor. It may be found that the walls are (for example) very near as regards colour and brightness to those obtaining in No. 7 of the above summary. If this is so, then the desired degree of illumination will be obtained by $\frac{20{,}000}{100} = 200$ c.ft. of low-pressure gas per hour, consumed in inverted burners arranged on the direct lighting principle. The usefulness of even this very limited summary is fairly wide when it is recalled that the influence of walls upon the distribution and degree of illumination is not of great importance, and may be safely ignored provided sufficiently deep reflectors are used. This does not mean that the brightness of the walls is of no importance in connection with artificial lighting, because, even though they may not modify the illumination of the working surface to a marked degree, they may have a remarkable psychological effect which will either supplement or detract from the general effect of the lighting units. The use of shades has, of course, the further advantage of preventing glare.

Having obtained in the above manner the gas consumption necessary to provide the required amount of light, it remains to determine the size and disposition of the units in which the gas should be consumed so as to ensure the light being properly distributed. This is a matter that must have more detailed treatment, and one which we may discuss on some future occasion. In the meantime, I would like to take this opportunity of expressing the hope that makers of gas lighting units will spare no pains to ascertain and provide the fullest possible data of their appliances. The merits of gas lighting as regards intrinsic brilliancy, colour, and hygiene, together with its low cost both as regards money and the destruction of coal, place it in the first rank of artificial illuminants. But all these features will, I think, acquire additional value by the compilation of practical data on the lines I have suggested.

DISCUSSION.

The PRESIDENT (Mr. S. B. Chandler, of the South Suburban Gas Company) remarked that the paper afforded proof of the vast strides which had been made in the application of gas to light, heat, and power. As to cooking, he took it that the better condition of meat which was cooked in a gas-oven arose from the fact that it was placed in a very hot chamber, which caused the sealing of the meat.

Mr. W. E. BROWN (Gas Light and Coke Company) asked whether it was not the case that, under the Factory Act, it was compulsory to whitewash the walls periodically.

Mr. CLARK replied that it was, but this took no account of its rate of depreciation from a lighting point of view. Whitewashing every fourteen months was evidently not enough sometimes to maintain its

reflecting power, though it might suffice from the hygienic point of view, which was no doubt what the regulation was founded upon. Of course, factories varied greatly in their degree of dirtiness; but he did not think the Act made any discrimination in this respect. It would evidently permit a reduction from 80 to 20 p.ct. of reflecting power; and this would mean a very serious loss, if it was necessary to depend upon the walls. But steel reflectors overcame this difficulty.

Mr. HOWARTH (South Metropolitan Gas Company) asked who were the people who were going to say what candle power was a practical one for the different trades, whose requirements varied widely. Would this be established by the inspectors of the Board of Trade?

Mr. CLARK said this remained to be seen. Apart from any action the Home Office might take, there were well recognized degrees of illumination which were desirable for particular trades. This factor had been worked-out very accurately by engineers; and there were notebooks now available for factory managers which would tell them how many foot-candles were needed for any class of work. These figures were the result of practical experience of what was desirable. It should be borne in mind that, whereas with a bad system of lighting a man might have (say) 5 p.ct. of throw-outs in his work, with good illumination the figure might perhaps be reduced to 2 p.ct.

Mr. HOWARTH wondered whether the authorities were going to say definitely that such-and-such candle power should be applied under certain conditions. If so, Mr. Clark's table would be very valuable.

Mr. CLARK remarked that it would be valuable when it was supplemented by a number of other observations—when it was so extended as to cover as many combinations of conditions as possible. In its present form, it was merely a suggestion.

Mr. D. J. WINSLOW, referring to meat cooking tests by large caterers, which had resulted favourably to gas, said he took it that cooking joints with a 10 p.ct. loss had actually been tried, and the plan had been found not good enough, and so had been discarded in favour of a 20 p.ct. loss. If so, this was a very valuable point for gas men to keep in mind.

Mr. CLARK replied that such firms were not likely to leave any stone unturned in these matters. They took up everything, and had certainly studied electric cooking in all its branches; and they had arrived at the conclusion that a loss of from 18 to 24 p ct.—it varied with different joints—was necessary to produce cooked meat that was palatable enough for the public. The fact that firms of this character did not try to economize to the extent of the difference between 10 and 20 p.ct., was a grand piece of testimony against electric cooking.

Mr. W. L. WESTBROOK (North Middlesex Gas Company) pointed out that in factory lighting an important consideration was the position of the light in relation to the work. In many cases absence of shadow was as desirable as adequate illumination. He himself had come across evidence of the conservatism of factory employees in sticking to flat-flame burners. In a place where there were many moving machines, with a universal swivel joint one could turn a flat-flame in all positions, and so do, in order to avoid shadow, what could not be accomplished with an inverted burner or an electric light. There might be cases in which it would be impossible to supersede the flat-flame burner. The merits of convected and radiant heat constituted a subject in which he had been immensely interested; and he had long ago come to the conclusion that, for office work at any rate, if at all possible they must get radiant heat every time. His experience with the flueless type of stoves had been that, if there was sufficient heat to make the room properly warm, products of combustion were so great that things were objectionable in this respect. Radiant heat, on the other hand, gave one a sense of comfort. Use should, however, be made as much as possible of the waste heat from flues.

Mr. H. W. KERRIDGE (Croydon Gas Company) related an experience in connection with an inquiry as to improving the lighting of a blacksmith's forge; and no satisfactory solution presented itself. In shoeing horses, the smith used a flat-flame burner with a swivel joint. It would be interesting to know what could be done to better this.

Mr. CLARK said there were instances such as had been mentioned where the flat-flame burner, in spite of its inefficiency, seemed to be the best thing available for the time being, though he hoped they would see the ultimate removal of these burners for all purposes.

The PRESIDENT said that Mr. Clark had given them a lot of information with regard to matters which gas engineers should have at their finger-tips. The question of cooking was a highly important one, in view of the fact that the gas-cooker represented a very large proportion of their load. Interest must be maintained in this phase of gas supply; and an eye must be kept on what their rivals were doing. The table which had been presented to them was a valuable one; and he was gratified to think that Mr. Clark had seen fit to give it to their Association. No doubt, it would be utilized to a much greater extent than even the author himself imagined. From all that had been said at the meeting, it would be quite obvious to those present that the knowledge required to-day by the distribution man was of a very much higher order than ever before. Those who desired to qualify for the better positions in the industry must acquire this knowledge; and this they could only do by close study and attendance at meetings and lectures, and generally looking after their work. For ordinary purposes, the flat-flame burner had gone; and in particular cases, such as those to which reference had been made, something, he thought, might be done by means of reflected light to overcome the difficulties. Prejudice was still to be met with, and unfortunately it did not stop at flat-flame burners. It was their mission to overcome this prejudice. They must further educate the consumer, and show him where he was wrong.

Mr. F. S. LARKIN (Gas Light and Coke Company), proposing a hearty vote of thanks to the author, remarked that the fact of the greater loss in weight of meat with gas cooking being an actual advantage was not really appreciated to the extent it should be. It was unnecessary to go beyond the experience of the big catering firms to get a definite idea as to what system was best. They were naturally after retaining in the meat all that was good; and if they found it advantageous to lose this 20 to 25 p.ct, and so improve the flavour of the meat, it was a sure guide to gas people that they were on the right lines. The question of the cost of cooking in electric and gas ovens would perhaps be a little better for gas than Mr. Clark gave them to understand, if they could only induce the makers in every case to fix a damper in relation to the gas-cock. In perhaps 90 p.ct. of the cookers which were out on a district at present, the flue-outlet was so large that it induced a violent current of air through the oven; and therefore more gas had to be used to maintain the temperature. With a damper regulated as he suggested, the flow of air through the oven could be reduced, he thought, to one-quarter of what occurred in the majority of cookers to-day. The boiling situation was far more satisfactory; but in neither case was it time for them to sit down and be content. Electric competition was going to be keener in the future than even now; and when their rivals had obtained all the efficiency in storage which gas possessed in the holder, gas people would have to look very sharp to keep ahead of them. It seemed to him that the advantages of gas from a coal conservation point of view should be put before the country in the most forcible manner possible. As to heating, many years ago convected heat was the one thing sought after; then there was the advent of radiant heat; and now convected heat was talked of again. He believed a balance would be found between the two which would give the best form of heat.

Mr. W. H. ASKER (South Suburban Gas Company), who seconded the vote, alluded to the change from open flame lighting to incandescent burners, and quoted the case of a works in which die-stamping was done by hand, by the aid of paraffin lamps. When the question cropped-up of improving the system of lighting, the men thought they would be unable to get incandescent burners near enough to their work. However, they did just what Mr. Clark said he had done in one case—they fitted up a trial shop, which proved very satisfactory, and led to about four more being treated in the same way.

Mr. CLARK, acknowledging the vote of thanks, referred to the regulation of the flue damper, in touching upon which, he said, Mr. Larkin had introduced an important matter. There was no doubt in these times room for immense improvement in the conservation of heat. As to the question of radiant and convected heat, his remarks were not intended to be in favour of convection pure and simple. It was important to try and determine what was the proper proportion of radiation to convection; and this would have to be carefully investigated. He was not quite sure whether flue heat ought always to be regarded as waste heat; it served quite a useful purpose in connection with ventilation. It remained to be determined how much must be reserved for the latter purpose. That the meat did not get sealed-up was an explanation of the fact that electrically cooked joints lost so much of their nutrient properties. One of the great features of the gas-oven was that it did seal-up the meat. As the President had observed, it was part of their business to fight every prejudice, and overcome it. Really it seemed sad to reflect that the flat-flame burner was still being used for purposes for which incandescent lighting would give a more economical and better illumination.

The Romance of Gas.

The intentions of the Advertising Section of the American Gas Association were set forth in the report which they submitted at the annual convention. They have made up their mind to spread broadcast the story of gas. There is, they say, as much romance in the gas industry as there is in the coal industry; but the story of coal has been told throughout the world, while the story of gas has never been popularly presented in the United States. The section plans a general publicity and advertising service for individual companies, and a publicity campaign for the gas industry as a whole. The programme has been limited to a few essentials, which will be accomplished thoroughly, rather than endeavour to enter upon an extensive advertising campaign that would require a large working force and an enormous expenditure of money. The section will be a clearing house for advertising and publicity copy issued by the companies belonging to the Association. Each company will be asked to send to the section at regular intervals clippings from local newspapers of advertisements by the gas company, news items about the company and about the industry, and publicity matter sent out to the newspapers. An advertising service will be one of the principal functions. The section will be at the service of the members for criticizing or preparing advertisements, &c., for special purposes. For the first year, three specific things are aimed at. The first is to publish through the advertising space of the gas companies in their local papers educational information of a broad fundamental character in regard to the gas industry, of a nature to which all gas companies can subscribe—*i.e.*, the conservation of natural resources through the carbonizing of coal, the principles of combustion and their application to gas, the great amount of capital invested in the industry, the importance of the services gas companies render, &c. The second aim is the preparation for publication of suitable articles; and the third, to give, as already mentioned, advertising assistance to companies.

Ethylene as Alcohol from Coke-Oven Gases.—Mr. Ernest Bury, General Works Manager to the Skinningrove Iron Company, Ltd., lecturing to the Cleveland Institution of Engineers at Middlesbrough, on Monday of last week, stated that at the works he had succeeded in extracting ethyl alcohol and its derivatives on a commercial scale from coke-oven gas. He pointed to the importance of this side of Cleveland's industry, not only as a sheet-anchor against depression in the iron and steel trade, but also from the aspect of the country's supply of liquid fuel. He observed that the world's liquid fuel resources are strictly limited, while the consumption is growing by leaps and bounds. His process, if developed, would render the country largely, if not entirely, independent of outside sources of supply. Early opportunity will be taken to deal more fully with what Mr. Bury had to say on the subject.

MIDLAND JUNIOR GAS ASSOCIATION.

A Meeting of the Midland Junior Gas Association was held at the Council House, Birmingham, on Thursday last, Mr. C. CARRINGTON BARBER (the President) occupying the chair. Two paperettes were read: (1) By Mr. Joseph Poulson, of Stafford, on the "Reconstruction of a Sulphate of Ammonia Plant"; and (2) "Some Gas-Furnace Installations," by Mr. H. R. HEMS, of the Industrial Research Laboratory, Birmingham.

RECONSTRUCTION OF A SULPHATE OF AMMONIA PLANT.

The sulphate-house and store were erected in 1902, and built on pitch-pine piles; this being necessitated by the subsiding nature of the ground. The plant-house measures 30 ft. by 32 ft., and the store 28 ft. by 13 ft. There is a central dividing wall between the plant room and the store; and a cast-iron liquor tank, measuring 30 ft. by 20 ft. by 5 ft. deep, composes the roof at the store end of the house. The saturator and dryer platform were 4 ft. above the floor, on the same level as the store room, to which access was made through an arched opening in the dividing wall. This feature has been retained in the reconstruction of the plant.

The plant, prior to reconstruction, consisted of the usual apparatus—a square main still, liming apparatus, and liming still (by Messrs. C. & W. Walker), a saturator (by Messrs. J. Taylor & Co.), heater, dryer, pumps, &c. The main still consists of 5 ft. square cast-iron sections fitted with external overflow pipes and removable front and back plates. There are a total of 21 trays; each tray having four removable hoods. The seven top trays are used as a free still, from which the liquor descends by gravitation through a 6-in. pipe into the liming still, and passes, mixed with milk of lime, from the top of the latter back into the remaining portion of the square still.

FAULTS OF THE OLD PLANT.

The concrete floor supporting the stills had fractured through settlement, causing the main still to be out of the vertical by 5 in. The efficiency of the still was thus impaired. The heater, of the annular type, had been long in use, and had during the previous few years been patched several times. A short period before the plant was taken out, the liquor inlet pipe was coupled direct to the main still, to avoid further loss of liquor through the faulty heater, the interior portion of which had become very thin. The saturator, which had been used even prior to being installed in the house in 1902, was undoubtedly not worth any further expense. Furthermore, it was too small for requirements. The mother-liquor well had also suffered from the settlement of the ground, and called for immediate remedial measures. The silica and alumina sludge that settled in the bottom of the liming vessel was emptied by means of a conical plug valve and lever into a shallow well directly under this vessel, and so had to be ladled out of it. The dryer had previously done good service; but its general condition was not worth the necessary repairs. The floor of the sulphate store room had also suffered by the subsiding ground. The edges of the blue bricks which composed the floor had cut the lead lining in many places. The waste-gas condensers consisted of a battery of 6 in. cast-iron flanged pipes, worn badly after so many years use. The waste-gas purifiers were built of blue bricks, and the continual settlement had caused fractures. Necessary arrangements were made for disposing of the ammoniacal liquor, the supply of a new heater, dryer, saturator, and the complete renewal of all lead work.

DISMANTLING THE PLANT.

The whole of the stills, saturator, pumps, steam and water pipes were dismantled, and all the sulphate store stripped. The staging for the saturator, mother liquor well, &c., was taken down, and the concrete floor burst-up. The filling-in material of the sulphate store was brought to ground level, so that practically all that remained was the building itself, which, by reason of the supporting piles, had not been affected by the subsidence of the ground.

NEW FOUNDATIONS.

It was necessary then to rebuild the new concrete floor from the cross timbers of the house, and into the existing walls. This was done; the floor being reinforced with two layers of heavy expanded metal. The position of the piers to support the stills was as previously, with the exception of that of the liming still. This was built 6 ft. away from the main still; so that, if necessary at any future time, the plant could be taken out without interfering with the remaining stills. Also, it was built further away from the staging than previously, for the operator's comfort. The piers were built a foot higher, so that a short bend could be fitted to the sludge outlet of the liming still. The walls of the mother liquor well, and the piers for the stills and saturator, were built of Staffordshire blue bricks and cement. To prevent damage to the lead lining, all sharp corners on the saturator platform were avoided by the use of bull-nosed bricks.

RE-ERECTION OF THE PLANT.

The sections of the square still were thoroughly cleaned, and the threads of all bolts and studs run-down with a die nut. The erection of the stills was then proceeded with. The jointing material used consisted of two parts glaziers putty, one part vulcan cement, one part red lead, mixed with boiled linseed oil. In this a soft cotton string was embedded. The liming still consists of a cylindrical body, shallow domed top, conical bottom, and inlet and outlet pipes. A 6-in. sludge outlet pipe and valve were fitted to the conical bottom, and the pipe led into the spent liquor pits at the back of the house. The new heater (by Messrs. C. & W. Walker) is 3 ft. in diameter by 8 ft. high, of cast-iron throughout. It consists of a flanged cylindrical body, fitted with flanged cap-shaped ends. The waste gases pass around 5 in. heavy cast-iron pipes, each end jointed in sockets cast upon a diaphragm plate bolted between the end and the body of the heater. The liquor is heated on its passage through the inside of the pipes.

PLATFORM AND STORE TIMBERING.

Blue brick piers were built on the concrete floor, and cross timbers laid on these to make a staging around the saturator, mother liquor well, and dryer. In the sulphate store, piers were inter-built with the walls, and cross timbers of 11 in. by 4 in. section laid. These were given a fall of 5 in. towards the dividing wall of the house, and a channel formed at this end. Red deal boards, 1½ in. thick, were closely laid at right angles to the timbers of the store-room and continued on to the saturator platform. These were securely fastened to the joints by means of ¾ in. beech dowels. The boards and dowels were brought to a good surface by means of an adze. Due provision was made for the avoidance of sharp corners. All timber was previously pickled with hot creosote. A hole was made in one of the main walls below the joists, and an arch turned over it, both for inspection purposes and to give access of air to the timbers.

LEAD WORK.

The sulphate store was lead lined—namely, bottom and sides, the latter to a height of 10 ft.—all joints being well lead burned as laid. By carrying the lead bottom up to the height of 1 ft. around the sides, this enabled a thinner lead to be used for the side sheets, which were burned to the lead floor. The lead was solidly worked into the channel previously made. This would carry away any drainage that might occur from the store. The floor sheeting was continued to the saturator, &c., staging, and carried up the wall on the two sides as in the store. The saturator pier was lead covered, and the mother liquor well lined—the latter with 10 lb. lead. Around the other sides of the platform, wooden rolls were made to a height of 10 in., and the lead sheeting of the floor worked over these. The joints were burned with a fine oxy-coal gas flame. In this manner, the floor of the stores and staging constituted a continuous tray, drained by means of the fall given to the floor and the channels into the mother liquor well, which has a capacity of 150 c.ft.

BOARDING OF FLOOR AND SIDES.

Timber joists were laid over the lead floor of the staging and store-room; those of the latter being tapered to counteract the fall given to the main joists below. On these, 1½ in. red deal boards were loosely laid, so that they could be taken up at any future time and the lead floor cleared of any accumulation of crystals. The sides were covered with 1 in. tongued and grooved match boarding, and nailed with copper nails to 3 in. by 2 in. timber grounds, which were secured by lead strips burned on the lead side sheets. This timber was also creosoted.

SATURATOR.

The saturator is of the open type, having a well for ejecting; the size being 4 ft. 9 in. by 3 ft. 6 in. by 3 ft. 4 in. deep, exclusive of well. The body is formed from plates 1¼ in. thick, with an apron of 1½ in.; the bottom and well being of 1¾ in. lead. It is made of the best refined Pattisonian process chemical plate lead, with a minimum of seams. Special attention was given to strengthening and webbing where needed, to ensure its keeping shape, and all is securely timber braced. The well is encased in a strongly bolted pitch-pine cradle; the saturator sitting solidly upon it. The saturator is fitted with double detachable ammonia pipes, detachable acid and steam pipes, detachable steam ejector, manhole and man lid, waste-gas outlet, and flange. With this type of saturator, not only can the salt be ejected, but, being of the open type, can be adapted to hand-fishing should the ejector need repairs or renewal. The double ammonia pipes are advantageous both for long life, and, being carried along the back and two sides, give that equalized distribution of the ammonia gases so desired. The perforated (leaden) steam-pipe has proved useful for dissolving the crystals that form round the ammonia pipes and saturator sides after the plant has been shut-down. Also, by putting the steam on at intervals for half a minute when the saturator is salting, a better contact is given to the ammonia gases with the acid, and the salt is blown to the front of the saturator into the well. A steam ejector lifts the mother liquor from the mother liquor well into the saturator.

DRYER.

The dryer was supplied by Messrs. Broadbent, of Huddersfield, and is of the steam-driven type, with lead-lined steel shell and perforated copper basket of 48 in. diameter, 16 in. deep, with hinged copper doors fitted in the bottom. Through these, the sulphate is discharged into the shoot below. The dryer is suspended on cast-iron standards, which are bolted to a cast-iron bedplate, and this, in turn, fixed on two larch timbers of 10 in. by 10 in. section directly over the mother liquor well. The liquor extracted from the sulphate is conveyed through a detachable cast-iron bend into the well.

PUMPS.

The pumps are of the vertical double-acting type (by Messrs. F. Pearn, of Manchester); one of them having been continuously used for over twenty years on the works. They were thoroughly overhauled and new parts fitted where needed; so they give us the confidence of reliability for many years' further wear.

WASTE-GAS CONDENSER.

This was made of a straight run of 18 in. cast-iron spigot and socket pipes, with ordinary run-lead joints. Flanged pieces were used at either end, and these were drilled to receive flanged and socket pieces for the inlet and outlet pipes. The cooling is effected by water, continuously pumped along the entire length of the condenser through a 1½ in. perforated pipe.

WASTE-GAS PURIFIERS.

These were built in concrete at the front of the house; the base measuring 41 ft. by 21 ft., having a thickness of 12 in. and reinforced with expanded metal. Side walls were cast to a height of 2 ft. 6 in.; and a central wall gave each purifier an internal measurement of 18 ft. square. The supporting walls for the grids measured 8 ft. square, and were built of 9 in. brickwork. Spaces were left in the brickwork so as to give extra distributing area for the waste gases.

STEAM-PIPES, CONNECTIONS, &c.

New steam-piping was installed throughout, and a new pressure-reducing valve fitted to the branch leading to the stills. A Wilton automatic spent liquor valve was fitted to the main still. The coupling-up of the various make-up pieces completed the re-erection of the plant. The covering of the stills with non-conducting composition is now in progress. The whole of the work, with the exception of the lead work (which was done by Messrs. Taylor & Co., of Bolton), was carried out by our own men.

WORKING OF THE PLANT.

Improvements are to be observed in the working of the plant. The increased efficiency of the heater and main still have resulted in very decided economy of steam, as we now get a waste liquor practically free from ammonia with a pressure of 10 lbs. on the steam brauch to the stills, whereas we previously worked at 16 to 18 lbs. A substantial increase of mother liquor has given us a corresponding increase of sulphate made, and the larger-sized saturator has proved beneficial both for increase and quality of the sulphate made. The dryer runs free from vibration, and gets its maximum speed of about 900 revolutions per minute in 30 to 40 seconds from starting, and after a 4 minutes run gives a moisture content in the sulphate of under 2 p.ct. The Wilton automatic spent liquor valve works very satisfactorily indeed, and is an improvement on the old seal-pot.

A process for making neutral dry sulphate is being proceeded with; and although at present I am only permitted to say that a salt practically neutral is being made, I hope to be able to give a detailed account of the process when circumstances are permissible. No sign of further settlement of the plant foundation has been observed.

DISCUSSION.

The CHAIRMAN moved a vote of thanks to Mr. Poulson for his "paperette;" remarking that the foundation difficulties at the Stafford Gas-Works were severe. Could the author give any information as to the capacity of the plant, the percentage of ammonia in the salt made, and the cost per ton?

Mr. W. J. PICKERING (Birmingham) seconded the resolution. He testified to the thorough way in which the reconstruction of the Stafford ammonia plant had been carried out. The market at the present time was for salt containing practically no free acid, and with water content as low as possible; and it would be interesting to have details of the method by which the neutral salt was to be produced.

Mr. W. BATT (Birmingham) commented favourably upon the reconstruction work of the sulphate plant.

Mr. H. W. DEAN (Nechells) inquired as to the cocoanut matting used in the whizzer, and expressed the view that the acid would attack the material. Had any other things been tried; and, if so, with what result?

Mr. T. A. HARVEY (Birmingham) observed that at the Saltley works sulphate plant they were able, by water-washing the salt in the whizzer, to get the acid content down to 0·01 p.ct., and they reduced their moisture content to 0·9 p.ct. The whizzer used at Saltley was not a Broadbent. The steam supplied in connection with the waste liquor was mentioned as at 10 lbs. pressure; and he asked the size of the steam connection and the steam consumption.

Mr. POULSON, in reply, said the capacity of the plant was nominally 4 tons of salt per day; and the plant, under working conditions, made from 3 to 3½ tons per day. Labour costs were 10s. 6d. per ton of salt; lime, 7s. per ton; and cost of fuel, 25s. per ton. The free acid in the salt before special treatment was 0·08 p.ct. The ammonia content of the salt before treatment was 25·35 to 25·45 p.ct.; and after the special treatment it rose to 25·62 p.ct. as an average figure. He congratulated Mr. Harvey on getting so low a figure for acidity and moisture by such a simple process of water-washing. The size of the steam service was ordinary 2-in. piping; but he regretted he could not give the figure for steam consumption. As regarded the use of cocoanut matting in the whizzer, copper gauze had been tried, and it behaved fairly well; but its use was rather expensive. Calico sheeting was too thin, and was unsuccessful, as the pores quickly filled up. The cost of cocoanut matting was about 8s. for a life of seven weeks. The process of making neutral dry salt consisted of a special neutralizing process combined with mechanical drying; and the process destroyed the hygroscopic nature of the salt. He invited members later on to pay a visit to Stafford and see the process working, when he would be able to furnish details in proper form. The make of salt with the horizontal retorts only at work, was 22 lbs. per ton; but with the verticals at work, with steaming, the make had risen to 30·5 lbs.

Notice of the second "paperette" must (on account of its length) be held over. The subject dealt with by Mr. H. R. Hems was "Some Interesting Gas-Furnace Installations."

YORKSHIRE JUNIOR GAS ASSOCIATION.

A very good attendance was recorded at a special general meeting of the above Association held on Saturday last at the Corporation Gas Show-Rooms, Darley Street, Bradford.

REPORT AND ACCOUNTS.

The financial position of the Association was thoroughly discussed; and, on the motion of Mr. J. W. ROPER (Bradford) seconded by Mr. E. A. LEASK (Leeds), the annual report and statement of accounts were duly adopted.

As a result of a large majority (by postal vote) in favour of an inclusive subscription with a free copy of the "Joint Transactions," Mr. LEASK (Leeds) proposed, and Mr. G. V. EDWARDS (Leeds) seconded, that Rule No. 7 be altered as follows:

> The subscription shall be 12s. 6d. per annum to each member on attaining the age of 21; under that age, 10s.

The motion was unanimously carried.

NATIONAL ASSOCIATION OF TECHNICAL GAS OFFICIALS.

The Hon. Secretary (Mr. F. Peel) gave an exhaustive report on the preliminary efforts and proceedings leading up to the formation of the National Association of Technical Gas Officials, and supplied details to the members of the proposed draft rules of the Association.

It was unanimously resolved—"That this meeting regrets the tendency in some gas undertakings to ignore the claims of the technical staff when advances are being voted to the workmen, and heartily approves of the formation of a National Association of Technical Gas Officials, and gives power to the Council to take steps in any direction which they think fit."

EDUCATION SCHEME.

Mr. E. L. OUGHTON (Longwood) as representative of the Association on the Education Sub-Committee dealing with the proposed scheme of education for gas engineers reported upon the developments and the present state of the scheme.

A vote of thanks was tendered to Mr. Chas. Wood (the Gas Engineer and Manager of the Bradford Corporation) for his kindness in providing the Association with the use of the demonstration room for the meeting.

The meeting concluded with a vote of sympathy to Mr. J. W. Lee (Hasland) in connection with his recent urgent operation.

American Refractories Manufacturers' Association.

In a paper presented at the meeting of the American Chemical Society, on the "Work of the Technical Division of the Refractories Manufacturers' Association," Mr. R. M. Howe said that the characteristics of fire-clay vary considerably, not only in different districts, but in different deposits of the same district, and in different sections of the same deposit. It is necessary to have complete data available as to the extensiveness and quality of a deposit. Accordingly, the practice of securing drill cores is growing; and these are tested thoroughly. Such tests give the requisite information, and make it possible to recognize the good and bad material by visual methods. It is remarkable that most of these systematic studies reveal the fact that good clay is being rejected or left in the mine because of a difference in colour, hardness, or structure. Less often, undesirable clay is used. Tests to show how different amounts of water affect the structure of fire-brick, led to the conclusion that the following rules apply, when sufficient pressure is used in shaping a fire-brick: (1) Increasing the water-content increases the strength of a fire brick until a limit is reached, after which further addition of water lowers the strength. (2) Increasing the water-content decreases the porosity of a fire-brick until a limit is reached, after which further addition of water increases the porosity. (3) An excess of water does not affect the density of a fire-brick as much as an insufficient amount. Time of "pugging," too, plays an important part in controlling the properties of fire-clay brick; and a few figures are available which show how long and short pugging affects strength. For example, one batch of brick which was made from rapidly pugged clay had an average end-crushing strength of 31,667 lbs. Another batch made from the same clays, when pugged longer, had an end-crushing strength of 42,767 lbs. Still other batches showed strengths of 36,366 and 46,000 lbs. for short and long time of pugging. From what has been said as to the influence of water and pugging, one can appreciate how bricks made by different processes must vary.

A Suction Gas Motor Lorry.—Dr. J. H. Paterson, in a paper read before the Newcastle Section of the Society of Chemical Industry, on the theory of gas producer reactions, with special reference to the rate of gasification, described a suction-gas motor-lorry, with internal combustion engine. With this arrangement, he said, the cost of running was equivalent to petrol at 3d. per gallon. The principle could be applied to any existing petrol-driven vehicle.

SOME TECHNICAL PROBLEMS OF THE FUTURE.

By T. B. SMITH, of Stocksbridge.

[A Paper read before the Coke-Oven Managers' Association on Dec. 20.]

The great war, if nothing else, has given the chemical industry of this country fresh impetus. For four years, we had to rely entirely on our own resources for the manufacture of hundreds of chemicals which we had previously imported. The situation was bravely faced; and after a time all demands fully met. We have shown what can be done; and it is to be hoped we shall not in the future have to rely upon Germany to develop our industry, as we did in the past. It is because I feel sure that the discussed opinions of a body of practical men upon the following suggestions will be invaluable to the future pioneers of the coking and bye-product industry that I have ventured to bring them forward.

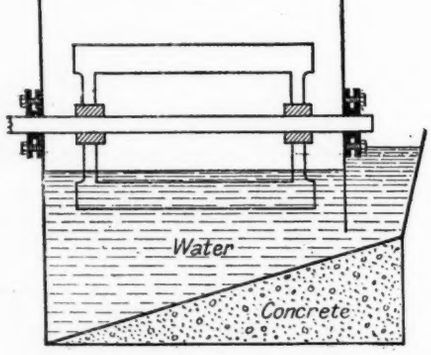
GAS PRODUCERS IN CONJUNCTION WITH COKE-OVENS.

For many years this has been a subject of lively interest to gas and chemical engineers; but very little advance has been made. The results obtained at the low-temperature carbonization experimental plant at Barugh show that as good results can be obtained by heating retorts or ovens with Mond producer gas as with the usual coal gas of higher calorific value. In the starting-up of a coke-oven plant—especially during the present period of high wages—the labour charges during the six or eight weeks period of hand-firing is a considerable item, and would go a long way towards paying the cost of erecting such a producer.

The application of gas of low calorific value to the usual type of coke-ovens is not difficult. Let us assume that an existing battery of ovens is heated by gas of 480 B.Th.U. per c.ft. from a series of tuyeres at a pressure of 5-10ths. Then to change to a gas of 120 B.Th.U. per c.ft., the same tuyeres would answer without alteration to air-ports, &c., by using the gas at a pressure of 2 in. or, as is actually found, a little more than 2 in., to allow for the specific heat of the larger amount of inert gases contained in producer gas, at the temperature of the stack. The crude gas would have to be washed free from the large amount of dust, which is mechanically carried over with it from the producer, since not only would the gas-mains and flues become blocked-up, but dust has a powerful cutting or scouring effect upon the flue walls, when travelling at even moderate velocity. Experiments which I have carried out with dusty gas were disastrous; mains 3 ft. diameter being entirely blocked after three months' work.

The usual, and perhaps the best, method of washing the gas free from dust, and extracting the ammonia, does not require a very considerable amount of plant. When leaving the producer, the gas immediately enters a large baffle-box in which a considerable amount of the dust is dropped, and is removed from the base by means of a worm conveyor. In some instances I have known this dust very rich in soluble phosphates.

The washer into which the gas is next passed is shown in section. This washer varies in length according to the capacity of the plant. It is sealed with water, which is dashed into the travelling gas in the reverse direction; the dashers being composed of paddles attached to a horizontal shaft passing through the washer and driven by electric or steam power. The number of dashers



n the cooler depends upon the capacity of the plant. Generally they are 12 to 14 ft. apart; and for a 20-ton per day producer three would be sufficient. The dust washed from the gas falls to the bottom and can be extracted from the lute. It is found that the temperature of the washer is so high that no ammonia is absorbed by the water.

After passing through a spray catcher, the gas passes into the ammonia absorber, which is exactly the same in design as the dust washer. In the ammonia absorber the gas is washed with 5 p.ct. of H_2SO_4; the B.O.V. being run in at one end, and when a fairly high specific gravity is obtained—due to the solution of ammonium sulphate—the liquor is run from the other end (where the gas enters) to the sulphate plant, which consists of a series of evaporators with bottom discharges over crystallizing tables. After passing another spray catcher, the gas is fairly clean, and can be led to the ovens.

I might say that I have successfully extracted the ammonia in an ordinary Coppée semi-direct plant, and by means of an ordinary indirect plant.

One great advantage of such an addition to coke-oven plants would be that during the present period of industrial unrest the trouble and worry caused by strikes, lock-outs, &c., would be considerably diminished. Two men can during such a disturbance work a producer for twenty-four hours—gasifying in this period 20 tons of coal. Generally speaking, it is possible to obtain 120,000 c.ft. of gas of a calorific value of 120 B.Th.U. per c.ft. from one ton of inferior coal containing up to 30 p.ct. of ash. Thus two men can produce in one day 268,800,000 B.Th.U., equal to 537,600 c.ft. of coke-oven gas at 500 B.Th.U. per c.ft., or 53·76 tons of coal.

Also, no heat would be taken from the battery for carbonizing the coal, as would be the case if the ovens were pushed, which would, even in regenerative ovens, require 50 p.ct., leaving only the remaining 50 p.ct. available for heating the battery itself, to make up for radiation losses. Hence a 20-ton per day gas producer worked by two men would put into the battery as much heat per day as would be obtained by carbonizing in regenerative ovens 107·52 tons of coal—in other words, by operating 13½ eight-ton ovens, which would require the services of a full shift of men.

Not only can inferior, dirty, and oxidized coal be used, but the recovery of ammonia is a great consideration, since it is possible to recover 80 lbs. of sulphate per ton of such coal containing an average nitrogen content.

If we draw-up a balance-sheet of the revenue of such an addition to our plants, we obtain results which highly commend the displacement of coke-oven gas by producer gas.

20 tons of inferior coal at 25s.	£25	0	0	14·3 cwt. sulphate of ammonia at £20	£14	6	0
6 men at 14s. per eight-hour shift	4	4	0	268,800,000 B.Th.U.	22	17	6
14·3 cwt. B.O.V. at 120s.	4	5	6				
Depreciation and interest on capital outlay, 15 p.ct. on £3000	1	4	0				
Power, stores, &c.	2	10	0				
	£37	3	6		£37	3	6

Hence we have 268,800,000 B.Th.U. at a cost of £22 17s. 6d.; and if we use this in the flues of a battery of coke-ovens we displace its equivalent, 537,600 c.ft. of average coke-oven gas at 10·2d. per 1000 c.ft.; and allowing 0·3d. per 1000 c.ft. of gas for purification, the net cost per 1000 c.ft. of gas into the holder would be 10½d.

This gas must not be confused with surplus gas, which is entirely separate. It is actually manufactured gas over and above the natural surplus, at a cost which few gas-works can attain. Coal will, of course, vary in price; but inferior coal is always obtainable, and if cheaper we should get:

Coal at 20s. per ton, 8·16d. per 1000 c.ft.
" 15s. " 6·10d. "

To summarize. If we have a regenerative plant with producers we should have the advantages of both the coke-oven plant and the gas-works, since we should get the metallurgical coke and bye-products together with 50 p.ct. of the gas made at minute cost, and the remaining 50 p.ct. of gas produced at a cost of from 6·1d. to 10·5d. per 1000 c.ft.

THE FUTURE FOR PITCH.

Although the sale of pitch is now easier by far, it will take a great number of years to use up the huge stocks which have accumulated during the war. As with every other commercial article, the price of pitch varies with the demand. Is it not, therefore, first up to our industry to increase the demand for this commodity by bringing forward new processes for its consumption? Let us for a few moments look at the subject from both the chemical and the physical sides.

1. *Chemical Side.*—Pitch appears, except in rare cases, to represent the limit of the practical application of results obtained from the systemic research of coal tar. If we can but isolate them, we have far more valuable compounds in the residue from the distillation of coal tar than are at present obtained from the distillates. The isolation of these products will obviously be very gradual; but in the interim it behoves us to use to the greatest advantage this complex and little-understood compound.

During the war the sudden shortage of pure carbon for arc lamp carbons and other electrical instruments brought up a great possibility—these having previously been manufactured in Germany from retort-carbon and the residual pitch from the distillation of crude petroleum. This pitch was carbonized in retorts; the solid and semi-solid volatile matter distilled-over being purified and sold to meet various demands—such substances as vaseline, paraffin wax, &c., being produced in this manner. The coke obtained, being almost entirely free from sulphur and ash, was ground to a fine powder, and with a suitable flux cast into the required shape and baked.

I am given to understand that the Ministry of Munitions caused experiments to be carried out during the war with the object of

similarly treating coal-tar pitch. I have been unable to obtain any official figures; but I have carbonized a quantity of ordinary pitch, the carbon obtained containing 0·15 p.ct. of ash, 0·07 p.ct. of sulphur, and part of the condensed volatile matter was found to be suitable for tub and wagon grease, for which there is a fairly large demand.

2. *Physical Side.*—The enormous calorific value of pitch is rarely considered, since it is so extremely difficult to burn it efficiently under boilers, &c. I would like, however, to bring to your notice a suggestion.

If we look back through the history of gas producer plants, we find a suction producer designed for the gasification of bituminous fuels in such a manner that the volatile hydrocarbons, instead of being carried forward and deposited in the supply pipes and on the valves of the engine, is converted into carbon monoxide and hydrogen. The producer was a complete reverse of previous and present practice. Instead of air and steam being drawn in below the fire-bars, and the gas being led away from the top, the air and steam were drawn in at the top of the producer, the gas being led away from beneath the bars. The reason for this was that the necessary air could be admitted to burn-up the volatile hydrocarbons while passing through the fire zone on its downward travel and convert it into carbon dioxide and water vapour, which were then reduced by the incandescent carbon to carbon monoxide and hydrogen.

It was found that only by a constant feed could these hopes be realized, since—assuming the gas-engine or exhauster to be constant in its suction, and the air inlet regulated to admit the requisite amount of air to make good gas from the coke after carbonization of a charge has finished—the supply of air would be inadequate when a fresh charge is dropped in to burn all the volatile matter, some of which was found to distil through the fire and condense in the mains. Also the vapour pressure of these hydrocarbons was found to reduce the suction of air at the time when needed most.

Would it not be possible to obtain a constant feed of liquid pitch (heated to fluidity by the radiant heat from the producer), which could be ejected on to the bed of fuel by means of the necessary air and steam for its combustion? A very much greater efficiency could be obtained by converting pitch into such gases, and burning the latter in boilers, oven flues, &c., than by burning it direct. Also smoking chimney stacks would be avoided. Such procedure could be applied to both pressure and suction plants, and part solid fuel and part liquid fuel used as desired.

Our report of the discussion is unavoidably held over.

U.S. Bureau of Mines and Helium Production.

Bulletin No. 178 C. of the United States Bureau of Mines, gives an interesting account of the war development of plants for helium production—though, probably as a war measure, the name "argon" was substituted for helium, and the three experimental plants finally constructed became known as argon plants. It is explained that one of these, the Norton process, is the latest practicable development in liquefying and separating gases. The Linde process (Plant No. 1) depends upon the so-called Joule-Thomson effect, obtained by the sudden expansion of a highly compressed gas through a small orifice, or nozzle, and the consequent cooling of the gas; the process being elaborated into a self-intensive or cumulative cycle of heat interchange by causing the cooled gas, on escaping, to circulate around the tube leading the initial gas into the apparatus. George Claude, of Paris, conceived the idea of a liquefaction cycle with an expansion engine interpolated. Though the Joule-Thomson effect is used in the Claude cycle (Plant No. 2), its value is reduced to a minimum, because the compression of the gas in this system is lowered. The maximum cooling effect is produced by the expansion engine, because the compressed gas, on expanding in the engine cylinder, is made to do work, and thus its temperature is lowered. In the Norton process (Plant No. 3) three expansion engines are used, liquid is throttled, and the heat interchanger and fractionating still are of new design. In the Linde system an enormous expenditure of power is demanded to compress the gas in order to obtain the maximum effect of throttling; and this energy is then wasted. The Claude system requires much less compression power; but in this system the energy stored in the compressed gas is also dissipated. In the Norton system the requirement for gas compression is reduced to a minimum by the interpolation of the multiple-expansion engines, and what is needed is conserved and reapplied through the energy developed by these engines. Thus the maximum cooling effect is obtained at a minimum cost. As the result of experiments made and work done, it is confidently expected that helium of the highest purity will soon be produced by Plant No. 3 on a large scale.

Lighting of Public Streets.—A writer in the "Saturday Magazine" of October, 1838, said: The brilliant display of gas-flames which the streets of London and other large towns exhibit, has now become so familiar to the inhabitants that a return to the use of the old oil-lamps would be regarded as a public misfortune. But what should we say if, instead of gas or oil lamps, elevated on posts, we had a lamp suspended from a string, which stretched from house to house across the street? And yet this latter mode was considered, in its day, as a most important item of advancement in social comfort.

MISCELLANEOUS NEWS.

CHARGING FOR GAS ON THE HEAT-UNIT BASIS.

Clauses from Private Bill Promotions.

The intentions of promoters of Gas Bills in the next session of Parliament, as indicated by the notices given, were summarized in the numbers of the "JOURNAL" for Nov. 25 and Dec. 2 [pp. 444, 499]. Copies of the Bills are now available; and from some of these have been extracted the clauses having reference to charging for gas on the heat-unit basis. Other proposals contained in the Bills will be noticed later on in the ordinary course. The Commercial Gas Company's Bill, it may be mentioned, has been dropped.

SOUTH METROPOLITAN GAS BILL.

The clauses in the South Metropolitan Gas Company's Bill in this connection are Nos. 3 to 23.

HEAT UNIT BASIS FOR GAS SUPPLY.

3.—The standard unit shall be 100,000 British thermal units.

4.—Within six months from the passing of this Act the gas supplied by the Company shall be gas of the declared calorific value.

5.—For the purposes of this Act the number of standard units supplied shall be ascertained from time to time by multiplying the number of British thermal units comprised in the declared calorific value of the gas by the number of cubic feet thereof supplied, and dividing the resulting sum by 100,000.

6.—The Company shall, by notice in writing to the Board of Trade, the London County Council, and the Council of each Metropolitan borough or urban district within or partly within the limits of supply of the Company, declare the calorific value of the gas which the Company intend to supply under this Act. The Company may from time to time, by similar notice in writing, declare their intention to supply gas of a different calorific value from the calorific value as last declared; and the calorific value as so last declared by the Company shall thereafter be the declared calorific value for the purpose of this Act unless and until varied by subsequent declaration.

7.—Before the Company supply gas of a declared calorific value, and in the event of the Company declaring their intention to supply gas of a different calorific value from the calorific value as last declared, the Company shall make preparations for any readjustment of consumers' appliances which may be required in consequence of such supply or alteration, and so that the gas supplied can be burned in such appliances with safety and efficiency. All adjustments required to be made by this section shall be carried out by the Company with all reasonable speed and without charge to the consumer.

8.—The calorific value of the gas shall be continuously measured and recorded by recording calorimeters of a type or types to be prescribed by the Metropolitan Gas Referees. The method of installing, using, and verifying such calorimeters shall be such as shall be prescribed by the Metropolitan Gas Referees, who are hereby empowered to prescribe the same.

9.—After the expiration of a period of four years from the passing of this Act, the pressure of gas supplied by the Company in any main or service pipe of 2 in. diameter or upwards shall (except in the case of accident or repairs) be such as will balance a column of water not less than 20-10ths of an inch in height.

10.—The amount of inert constituents in the gas supplied by the Company during a period of two years from the passing of this Act shall not exceed 20 p.ct., and for the subsequent period of two years shall not exceed 18 p.ct., and after the expiration of such last-mentioned period shall not exceed 15 p.ct. of the volume of the gas.

11.—The mode of ascertaining the percentage of inert constituents in the gas shall be prescribed by the Metropolitan Gas Referees.

12.—If on any day the gas supplied by the Company is found to be above or below the declared calorific value, the Company shall be liable to the following forfeitures in respect of the variation on that day (that is to say):

If the excess or deficiency exceeds 5 p.ct. but does not amount to 10 p.ct., a sum not exceeding £2.
If the excess or deficiency exceeds 10 p.ct. but does not amount to 15 p.ct., a sum not exceeding £5.
For each complete 1 p.ct. above or below 15 p.ct., a sum not exceeding £10.

13.—If on any one day the gas supplied by the Company at any testing-place contains a greater percentage of inert constituents than is permitted by this Act, the Company shall be liable to a forfeiture not exceeding £10 for each day on which they are so in default.

14.—If on any one day the gas supplied by the Company at any testing-place varies by more than 5 p.ct. from the declared calorific value, or contains a greater percentage of inert constituents than is permitted by this Act, the average of all testings for calorific value or for inert constituents made at such testing-place on that day, and on the preceding day, and on the following day shall be deemed to represent the calorific value of or, as the case may be, the percentage of inert constituents in the gas on such one day at such testing-place.

15.—Subject to the provisions of this Act, the Act of 1876 and in their relation to the Company the Gaslight and Coke and other Gas Companies' Acts Amendment Act, 1880, and the London Gas Act, 1905, shall be read and construed as if the declared calorific value were the illuminating power prescribed for the gas of the Company by the London Gas Act, 1905, and the pressure prescribed by this Act were a pressure prescribed by any provision of those Acts, and as if any reference in the said Acts of 1876, 1880, and 1905 to purity or defect in purity were a reference to inert constituents or an excess of inert constituents, as the case may be, and as if the forfeitures prescribed by this

Act were forfeitures prescribed by or referred to in the said Acts of 1880 and 1905, or either of them.

PRICE OF GAS AND DIVIDENDS.

16.—The basic price of gas supplied under the powers of this Act shall be 11d. for each standard unit; and that price is in this Act referred to as the "basic price."

17.—The Company may, subject to and in accordance with the provisions of this Act, increase or reduce the price charged by them above or below the basic price; but except as by this Act otherwise provided the Company shall not in any one year declare any larger dividend on the ordinary stock of the Company than a dividend at the rate of £6 in respect of every £100 of the said stock for the time being paid up; and the said rate of dividend is in this Act referred to as the "authorized rate."

18.—Whereas it is expedient that the surplus profits of the Company should in the future be divided in the following proportions—namely, three-fourths to the consumers and one-fourth equally between the ordinary stockholders and the employee co-partners of the Company, the following provisions shall apply (that is to say):

(1) At the end of each year or half year a sum shall be calculated representing the amount by which the total amount payable by consumers during such year or half year has been less than the amount which would have been payable if the gas had been charged for at the basic price, and such sum so calculated shall be called the "consumers' share;" and for the purposes of this section the "surplus profits" shall mean a sum of which the consumers' share is three-quarters.

(2) If, and so far as, the balance standing to the credit of the net revenue account after providing for dividend on the preference stock and dividend at the authorized rate on the ordinary stock in the opinion of the Directors permits, a sum not exceeding one-quarter of the surplus profits shall be applied in two equal parts for the benefit of the holders of ordinary stock and for the benefit of the employee co-partners of the Company in manner hereinafter mentioned.

(3) Any sum so to be applied for the benefit of the holders of ordinary stock may be applied in the increase of the dividends above the authorized rate and if, and so far as, not so applied shall be carried to the reserve fund.

(4) The sum so to be applied for the benefit of the employee co-partners of the Company shall be carried to the co-partnership fund. The moneys so carried to the co-partnership fund shall be allocated by way of a uniform percentage of bonus on the salaries and wages of the employee co-partners of the Company. The trustees of the co-partnership fund shall be the persons who are for the time being the Employee Directors of the Company elected under the provisions of the South Metropolitan Gas Acts of 1896 and 1897, together with the persons who are for the time being the Chairman and Secretary of the Company.

(5) Any balance of the profits of the Company not applied as aforesaid shall be carried to the credit of the net revenue account of the Company for the next following year or half year. Provided that the sum standing to the credit of such net revenue account shall not at any time exceed the amount required to pay one year's dividend on the preference stock and one year's dividend at the authorized rate on the ordinary stock of the Company.

19.—If the Chief Gas Examiner appointed under section 40 of the Act of 1876 shall certify in respect of any year or half year that the testing of the gas supplied by the Company during such year or half year has shown the gas to contain on an average less than one part by volume of carbon bisulphide vapour per 40,000 volumes of gas, then, notwithstanding any other provisions of this Act, the sum payable by consumers taken into calculation in determining the consumers' share for the purposes of the last preceding section of this Act shall be deemed to have been one-farthing per standard unit less than the sum actually payable.

20.—The Company shall not charge for the hire of any prepayment meter or any fittings used therewith any sum other than a sum of money calculated according to the number of standard units supplied through such prepayment meter. The sum so charged shall not be more than 1¾d. for each standard unit so supplied, and shall include the hire of one meter and any fittings used therewith, and shall include the providing, letting, fixing, repairing, and maintenance of the meter and fittings (if any), and the cost of collection, inspection, and any other cost incurred by the Company in connection with the meter and fittings (if any).

21.—The Company shall clearly show on each receipt for a payment for gas supplied by means of a prepayment meter the rate per standard unit charged for the gas and the rate in respect of the meter and the fittings (if any) used therewith.

22.—The Directors may in any year declare and pay an interim half-yearly dividend on any class or classes of stock in the capital of the Company without the sanction or direction of a general meeting; but no such half-yearly dividend shall exceed one-half of the amount of the authorized rate of dividend payable on such stock.

23.—The Directors may close the register of transfers for a period not exceeding fourteen days previous to the declaration of any interim dividend, and they may fix a day for closing the same of which seven days' notice shall be given by advertisement in some newspaper published or circulating within the limits of supply of the Company; and any transfer made during the time when the transfer books are so closed shall as between the Company and the person claiming under the same, but not otherwise, be considered as made subsequently to the declaration of any such dividend.

SOUTH SUBURBAN GAS BILL.

Part IV. of the South Suburban Gas Company's Bill is reproduced.

ALTERATION OF BASIS OF CHARGE AND OF SLIDING-SCALE.

12.—The provisions of this part of this Act shall come into operation as from the date, or respective dates, of the reading of the meter-indices for the December quarter of the year 1920; and the said date or dates is or are in this part of this Act referred to as the "commencement of this part of this Act."

13.—The provisions of Part IV. (calorific value and testing) of the Act of 1912 as amended by this part of this Act shall be read, and have effect, as if they had been enacted with reference to the whole of the area of supply as constituted at the passing of this Act, instead of to the specified districts referred to in the said Part IV. Provided that for the purposes of this Act section 42 (South Suburban Company to provide apparatus for testing calorific value) of the Act of 1912 shall be read, and have effect, as regards the area of supply other than the said specified districts as if the commencement of this part of this Act had been therein referred to, instead of the "date of transfer."

14.—As from the commencement of this part of this Act Part IV. (calorific value and testing) of the Act of 1912 shall be, and is hereby, amended as follows:

(*a*) The standard calorific value of the gas supplied by the Company shall, subject to the provisions of this Act, be 450 B.Th.U. gross per cubic foot, instead of the standard calorific value prescribed by paragraph (*d*) of sub-section (1) of section 43 (substituting standard calorific value for prescribed illuminating power).

(*b*) Sub-section (3) of section 44 (provisions as to testing for calorific value) shall be read, and have effect, as if a number of British thermal units less by 6 p.ct. than the number of such units comprised in the prescribed standard calorific value had been therein referred to, instead of 447 B.Th.U.

(*c*) Sub-section (4) of the said section 44 and section 45 (penalties for deficient calorific value) shall be read, and have effect, as if the number of British thermal units comprised in the prescribed standard calorific value had been therein referred to, instead of 475 B.Th.U.

15.—(1) Notwithstanding anything contained in section 43 (substituting standard calorific value for prescribed illuminating power), section 44 (provisions as to testing for calorific value), or section 45 (penalties for deficient calorific power) of the Act of 1912, or the sections of this Act of which the marginal notes are respectively "Extension to whole area of supply of Part IV. of Act of 1912" and "Amendments of Part IV. of Act of 1912," [sections 13 and 14] the Company may at any time, and from time to time at their discretion vary as regards either the whole or any part or parts of the area of supply the prescribed standard calorific value of the gas supplied by them as prescribed by the said section 43 (as amended by this Act), or as varied under the powers of this section, and may fix different standards of calorific value for different parts of that area. Provided that, not less than six months before making any such variation, the Company shall give notice in writing of their intention so to do to the local authority of every district within the area of supply with respect to the whole or part of which such variation is proposed to be made.

(2) Unless and until varied pursuant to this section, the standard calorific value prescribed by the said section 43 of the Act of 1912, as amended by the section of this Act of which the marginal note is "Amendment of Part IV. of Act of 1912," shall continue to be the prescribed standard calorific value of the gas supplied by the Company with respect to the whole of the area of supply; and the said sections 44 and 45 as amended by the section of this Act lastly hereinbefore referred to shall continue to apply and have effect, but as from the date on which any such variation as aforesaid shall take effect the standard or standards of calorific value for the time being fixed by the Company with reference to the whole of the area of supply or to different parts thereof shall, for the purposes of this Act and of all other enactments relating to the Company, and for all other purposes, be deemed to be as respects the whole of the area of supply or such parts thereof as aforesaid respectively the standard calorific value of the gas supplied by them.

(3) At any time within one year after any such variation as aforesaid shall have taken effect, the Company shall, if and when required by any consumer of gas supplied by them within the area to which such variation relates, make free of cost to such consumer such adjustments of the burners and fittings theretofore used by such consumer as may be necessary for adapting the same to the consumption of gas of the new calorific value fixed by the Company.

16.—Notwithstanding anything contained in any Act of or relating to the Company, the Company may manufacture or purchase and use for the purpose of supply gas or a mixture of gases derived from any source from which combustible gases are ordinarily obtained, provided that such gas or mixture—

(*a*) complies with the prescribed standard calorific value of the gas supplied by the Company.

(*b*) does not exhibit any trace of sulphuretted hydrogen when tested in accordance with the rules prescribed in that behalf in Part II. of Schedule A to the Gas-Works Clauses Act, 1871; and

(*c*) does not to the extent of more than the following percentages of its volume consist of nitrogen and carbon dioxide gas:

Until Dec. 31, 1922, 20 p.ct.
From Jan. 1, 1923, until Dec. 31, 1924, 18 p.ct.
From and after Jan. 1, 1925, 15 p.ct.

17.—Section 2 (as to standard price and rate of increase or decrease of dividend payable) of the Act of 1912 shall be, and the same is hereby, repealed.

18.—The rate of dividend payable on the ordinary stock of the Company shall (subject to the provisions of the section of this Act of which the marginal note is "Sliding-scale of price and dividend" [section 19] be £6 p.ct. per annum; and that rate is in this Act referred to as the "standard rate of dividend."

19.—The standard price to be charged by the Company for gas supplied by them shall be 1s. 2d. per calorific unit. Provided that the Company may increase or reduce the price charged by them for gas above or below the standard price subject to a reduction or increase in the dividend payable by the Company on their ordinary stock as follows:

In respect of any half year during any part of which the price per calorific unit charged by the Company for gas supplied by them in the inner area shall have been above the standard price, the dividend shall in respect of each two-ninths of a penny or

part thereof by which the price so charged shall have exceeded the standard price be at a rate per centum per annum less than the standard rate of dividend by 3s. 4d. on every £100 of stock, and so in proportion for any fraction of £100;

And in respect of any half year during the whole of which the price per calorific unit charged by the Company for gas supplied by them in the inner area shall have been below the standard price the dividend may in respect of each two-ninths of a penny by which the price so charged shall have been less than the standard price be at a rate per centum per annum exceeding the standard rate of dividend by 3s. 4d. on every £100 of stock, and so in proportion for any fraction of £100.

Provided that the Company shall not in respect of any half year earlier than the half year ending June 30, 1926, declare or pay a dividend on the ordinary stock at a higher rate than £6 p.ct. per annum.

20.—(1) The Company shall be at liberty to continue to use for the purpose of calculating the rent or charge to be paid by consumers for gas supplied to them all or any of the meters in use at the commencement of this part of this Act, and from time to time to renew such meters, and to fix and use like meters in connection with any new supplies which they may commence to furnish after such commencement.

(2) For the purpose of determining the amount of the rent or charge to be paid for gas supplied otherwise than by means of a prepayment meter, the number of cubic feet registered by the meter shall be multiplied by the number of British thermal units comprised in the prescribed standard calorific value; and the Company shall be deemed to have supplied the number of calorific units ascertained by dividing by 100,000 the product of such multiplication.

21.—As from the commencement of this part of this Act sections 35 (as to price of gas in Bromley district), 36 (as to price of gas in West Kent district), and sub-section (3) of section 37 (extension of limits of supply of South Suburban district) of the Act of 1912, sub-section (3) of section 32 (extension of limits of supply) of the Act of 1914, and section 30 (as to price of gas in Dartford district) of the Act of 1918, shall cease to have effect; and in lieu thereof the following provisions shall apply and have effect (that is to say):

(1) Until the dates hereinafter respectively mentioned, the price to be charged by the Company for gas supplied by them to persons who consume the same by meter in the portions of the area of supply respectively hereinafter referred to shall be a price per calorific unit exceeding by the following respective amounts the price per calorific unit for the time being charged by the Company in the inner area (that is to say):

(*a*) As regards the area specified in Part I. of the second schedule to this Act, until the date or respective dates of ascertainment of the register of meters for the December quarter of the year 1923, four-ninths of a penny;

(*b*) as regards the area specified in Part II. of the said second schedule—

(i) until the date or respective dates of ascertainment of the register of meters for the June quarter of the year 1921, one penny and one-ninth of a penny;

(ii) from such last-mentioned date or dates until the date or respective dates of ascertainment of the register of meters for the June quarter of the year 1922, eight-ninths of a penny;

(*c*) as regards the area specified in Part III. of the said second schedule—

(i) until the date or respective dates of ascertainment of the register of meters for the June quarter of the year 1922, three pence and one-ninth of a penny;

(ii) from such last-mentioned date or dates until the date or respective dates of ascertainment of the register of meters for the June quarter of the year 1925, one penny and five-ninths of a penny.

(2) As from the date or respective dates hereinbefore referred to with respect to the area (*a*) referred to in sub-section (1) of this section the price to be charged by the Company in that area shall be and continue the same as the price for the time being charged by the Company in the inner area:

(3) In respect of the period of twelve months commencing on the latest dates hereinbefore referred to with respect to the areas (*b*) and and (*c*) referred to in sub-section (1) of this section, and in respect of each subsequent period of twelve months, the amount of the difference between the price to be charged by the Company as aforesaid in those areas and the price for the time being charged in the inner area shall be reduced by two-ninths of a penny per calorific unit, until such difference shall be extinguished; and thereafter the price to be charged by the Company in those areas shall be and continue the same as the price for the time being charged by the Company in the inner area.

22.—In addition to the amendments expressly effected by this Act, all references in any Act or Order of, or relating to, the Company to cubic feet or a cubic foot (except in relation to the quality or purity of the gas supplied by the Company or the testing thereof or deficiencies therein) shall be construed as references to a number of calorific units to be ascertained by multiplying the number of cubic feet referred to in such Act or Order by the number of British thermal units comprised in the prescribed standard calorific value and dividing the product of such multiplication by 100,000.

23.—(1) Subject to the provisions of this section, it shall be lawful for the Company or the local authority of any district of which the whole or part is within the area of supply at any time after Jan. 1, 1926, and from time to time to apply to the Board of Trade for revision of the standard price.

(2) Simultaneously with the making of any such application if made by the Company, the Company shall give notice thereof in writing to the local authority of every district wholly or partly within the area of supply, and if made by a local authority such local authority shall give notice thereof in writing to the Company and to each other such local authority.

(3) Upon any such application, the Board of Trade shall take into consideration any increase or decrease in the cost of manufacturing and distributing gas (other than any increase attributable to defective management or any decrease attributable to the exercise by the Company of due care and management), and may, if they think fit (after considering any representations made to them in writing by the Company or by any such local authority as aforesaid), make a Provisional Order altering the standard price.

(4) As soon as practicable after the making of any such Provisional Order as aforesaid, the Board of Trade shall introduce into Parliament a Bill for confirming the same; and no such Provisional Order shall have any force or effect unless or until confirmed by Parliament.

(5) The Board of Trade may hold all such inquiries as they may think fit for the purposes of this section; and the party making the application shall pay to the Board of Trade such fees and expenses in connection with such application and the holding of any such inquiries and the preparation and passing of any such Bill as aforesaid as that Board may determine.

(6) If any Provisional Order shall be made and confirmed as aforesaid, no further application under this section shall be made until after the expiration of five years from the passing of the Act confirming such Order.

24.—As from Jan. 1, 1926, section 54 (pressure) of the Act of 1912 shall be read and have effect as if 20-10ths of one inch had been referred to therein, instead of 8-10ths of one inch, and as if there were added at the end of sub-section (1) thereof the words "and in such service-pipe if it be of a diameter of not less than 2 in."

WANDSWORTH, WIMBLEDON, AND EPSOM GAS BILL.

Section 17 of the Wandsworth, Wimbledon, and Epsom District Gas Company's Bill is as follows:

APPLICATION OF GENERAL ACT ALTERING BASIS OF SUPPLY AND CHARGE FOR GAS, &C.

17.—The Company may also apply their funds in providing any appliances or apparatus that may be necessary or desirable to enable them to conform to the provisions and obligations of any Public General Act which may be passed in the present or any ensuing session of Parliament, and which may make provision as to the basis upon which gas shall, or may, be supplied, or as to the basis or method of charging for gas, and may also take such steps as they may think fit to enable them to secure the benefit of, and to exercise, any powers of such Act.

BRIGHTON AND HOVE GAS BILL.

The matter is also referred to in section 29 of the Bill of the Brighton and Hove General Gas Company.

POWERS WITH REFERENCE TO SUPPLY ON HEAT UNIT BASIS.

29.—The Company may take any steps the Company may consider expedient to enable the Company to sell or supply gas wholly or in part on a heat-basis, or on any method or principle calculated according or with reference to the heat-units or declared heat-units in the gas supplied by the Company which may be made available for or applicable to gas undertakings under any Act passed in the present or any future session of Parliament, and may apply any funds of the Company for such purposes.

LONDON COUNTY COUNCIL AND METER AND STOVE RENTS.

The Action of the Gas Companies Justified.

In a report presented at last Friday's meeting of the London County Council, the Public Control Committee said that a question was raised at a meeting of the Council on Oct. 28 as to the action of certain gas companies in making an increased charge of 50 p.ct. on rentals of gas stoves and meters which, in many cases, have been in use by the consumers for a number of years; and the Chairman undertook to look into the matter. The Committee have accordingly been in communication with the Commercial, Gas Light and Coke, and the Wandsworth, Wimbledon, and Epsom District Gas Companies, who are the Companies concerned, and have asked them for information as to the reasons for their action, and as to the effect of such increases on the price of gas.

In the case of the Commercial Gas Company, it is asserted that, before the war, aggregate rentals were not sufficient to cover the repair and maintenance charges, apart from the interest on capital and depreciation. The increased expenditure on labour and material has necessitated the advance of 50 p.ct. in rentals, which, however, is not expected to be in excess of the maintenance charges alone. As regards the effect on the Company's revenue, the Company estimate that an increase of £7504 a year will result—equivalent to ½d. per 1000 c.ft. of gas sold during the year. The charges on three-light and five-light meters, which, by the Metropolis Gas Act, 1860, are limited to 10 p.ct. of the cost, have been raised from 2s. and 3s. 4d. to 3s. and 4s. a year respectively.

The Gas Light and Coke Company advance similar reasons for the increase in rentals of stoves and fittings; no increase being made in the rentals of meters. They state that during the last 36 years there has been a deficit of £300,000 on the total cost of repairs, without taking into account any interest on capital or depreciation, and without providing for a sinking fund. The consumers have the option of purchasing these stoves; and the Company anticipate that at least 60,000 will be bought. The Company's estimate of the increased rental of the reduced number of stoves, in a normal year, is £26,000—equivalent to 0·21d. per 1000 c.ft. decrease in the price of gas. The terms on which the stoves and fittings are offered to consumers appear to be reasonable, being four times the increased yearly rent; and they show a large reduction on present cost. The Company also state that, in the case of stoves purchased, they will in future carry out all repairs and maintenance at the cost of the necessary labour and material only. The Company do not appear to have taken into account the facts that

(1) they will be relieved of the obligation of repairing and maintaining stoves purchased, and (2) they will have the use of the purchase money for purposes of the undertaking. By the extent to which these items benefit the revenue account, the price of gas could be reduced.

The Wandsworth, Wimbledon, and Epsom District Company state that "the reasons which have brought about the increase in the rentals of meters, stoves, and other apparatus are entirely due to the increased cost of wages and materials required for their renewal, maintenance, and repairs. The increases have been from 110 to 200 p.ct. on pre-war prices for such materials; and therefore the rents must eventually go even higher. Thus, a stove which in 1914 cost £4 7s. 4d. in 1919 costs £8 19s. 4d., and a meter then costing £1 17s. is now £3 19s."

It has generally been understood that the Companies have in the past been prepared to supply stoves and fittings at less than cost, in order to develop the industry—looking to the profit from the increased sales of gas to recoup them for their expenditure. There must, of course, be some limit to this principle; and it appears to the Committee that the Companies have a good case for increasing the rents of meters and appliances on hire which not only give no return on capital, but involve a loss on maintenance. The Companies, moreover, appear to be acting within their legal rights in making these extra charges. The Committee cannot, therefore, advise the Council to take any action in the matter—especially as any increase of revenue from rents must, in present circumstances, which for practical purposes involve the suspension of the sliding-scale, be correspondingly reflected in the price charged for gas.

AN "ALL-GAS HOUSE" FOR PLYMOUTH.

An interesting contribution towards the solution of the housing problem is about to be made by the Plymouth and Stonehouse Gas Company. With a view to demonstrating the utility of gas in the household, they are about to erect at their Coxside works a cottage in which gas will be employed for all purposes of heating, lighting, and cooking. The cottage will be occupied by one of the Company's workmen, and will comprise parlour, living-room, scullery, three bedrooms, and bathroom, with the usual offices—the accommodation of an ordinary working man's home, according to the Ministry of Health standard.

Its one marked feature is that it has no fire-grates and no chimneys. Gas being installed throughout, grates and chimneys have been dispensed with. One result is a surprising saving of space in the rooms through the absence of chimney-breasts and other projections. Not only is more room-space obtained, but it is claimed that there is a saving of cost in building. The system of construction followed is that designed by Major F. Cornelius Wheeler [see "JOURNAL" for July 29 last, p. 241], by which the flues of the gas apparatus are conveyed in cavity walls. In this case, there is an outer wall of 4½ in. bricks, a 3-in. cavity, and an inner wall of 4½-in. brick; the two walls being braced together at intervals.

The domestic appliances make excellent demonstration of the utility of gas and its labour-saving properties. In the kitchen, the gas-cooker and hot-water circulator are placed in a recess, with a drying cupboard alongside. There is a sink, with hot and cold water and drainage board; while for washing clothes there is a gas-heated boiler. Lavatory basins, with hot and cold water, are provided in all bedrooms. In fact, there is every convenience which the most up-to-date domestic appliance of the kind can suggest for a house of its size.

A model of the dwelling has been made by the Gas Company's workmen, and is an object of great interest and attraction at the show-rooms. It is built to scale, and is complete to the smallest detail. Furniture, also to scale—one-eighth of the actual size—has been made by disabled soldiers at the local Lord Roberts Memorial Workshop; and the whole production is a splendid demonstration of what can be done under wise guidance to provide homes for working men in which labour may be reduced to a minimum and comfort studied in every way.

THE METRIC SYSTEM AND DECIMAL COINAGE IN THE GAS INDUSTRY.

[From the December Number of the "Decimal Educator."]

The metric system is so well known to most technical men that a discussion of its application to the gas industry might appear superfluous, if it were not evident from the opposition shown to its introduction by a section of gas engineers that the details of its application have not been thought-out by them. Few have made a study of the matter without becoming ardent advocates of the metric system and its use in gas-works; but busy men rarely afford the time for such a study. Hence the need for laying the matter before them in concise form.

Let us first consider the question of rapid calculations. Here we find that the relationship between the metric measures, being always ten, a hundred, or a thousand fold, promotes the use of slide rules and calculating apparatus to such an extent as to overshadow any small advantage arising out of the much-esteemed proportions of 2, 4, and 12, which are found irregularly dispersed among the British weights and measures. The sizes of the units are convenient—the metre for distances, the millimetre used with the vernier for high accuracy in the smallest dimensions, the kilogram and tonne for ordinary weighing, the gram and milligram for chemical work.

The identity in weight of a cubic metre of water with a metric ton, of a kilogram with the litre, and of the cubic centimetre with the gram affords a great advantage to the user of the metric system, in that the specific gravity of a substance is also its weight per cubic metre (in tons), per litre (in kilograms), and per c.c. (in grams).

In using the metric system and decimals generally, care should be taken to maintain a sense of proportion in regard to accuracy, and stop at the significant figure. There is obviously no meaning in the statement of a result with greater accuracy than the data will warrant. No chief engineer wishes to ascertain the weight of his stock of coal to the tenth of a ton—knowing well that many sources of error make such an attempt at accuracy ridiculous. Neither does he want a well to be measured to a millimetre, though he may demand that a gudgeon pin be gauged to the tenth of a millimetre.

Most hardware firms register the weight of their finished products, and the cost thereof per pound—obtaining thereby valuable knowledge of the general cost of bridges, boilers, dynamos, machine tools, &c. This practice is only slowly gaining ground in the gas industry, but should be more largely used, as it is of great value. Its adoption is much eased by the use of decimal methods, as the operations are much simplified. The florin and the kilogram are both based on reckoning in tens.

Under the metric system, work will be done as before, using the same tools, the same Whitworth screw-threads, and the same steel sections; but in speaking of them the "new yard," or metre, and the millimetre will be used instead of feet and inches and sixteenths.

Judging by the experience of metric countries, the inch will not disappear suddenly. It will long survive in drills and screw-threads, in sizes of bar iron and steel joists; but it will rapidly disappear in other dimensions, as evidenced in the drawings used on the Continent, where bolt holes are given in inch measurements, but lengths and distances between centre lines are given in millimetres as being more satisfactory. The round figures in feet and inches become longer when expressed in millimetres; but the odd lengths, which are more numerous, come out in simpler form. In stating a dimension to the nearest $\frac{1}{16}$ in. an accuracy to $\frac{1}{32}$ in. is attained; whereas a dimension stated in millimetres has an accuracy to $\frac{1}{50}$ in. Yet the operations of dimensioning a distance as 296 (using three signs), and marking it off on the work, are quicker and less liable to error than the corresponding operations with our equivalent 11$\frac{13}{16}$ in. (using nine separate marks or signs on the paper). If halving is required, the metric measures score again.

The simplicity of the metric system is best illustrated by instancing a case in practical work, such as the weight of a holder. The matter does not pass the bounds of ordinary arithmetic, yet what a long tale it is for us to calculate this out on our system of weights and measures. Under the metric system the solution is beautifully easy. First we have the fact that one atmosphere is the same pressure as that of 1 kilogram per square centimetre (1kg/cm²) and equivalent to a water column of 10 metres. A metric pressure gauge is marked in millimetres—*i.e.*, thousandths of an atmosphere. As a result the formula for ascertaining the weight of a holder becomes: Weight of holder (in kg.) = area of holder (square metres) × pressure (millimetres).

Now take the problem on p. 214 of Newbigging's Handbook [Eighth Edition]. If for the diameter of holder (56 ft.) we say 17 metres, and for pressure (25/10 in.) we say 63 mm.,

then area of holder = 227 square metres, and
weight of holder = 227 (area) × 63 (pressure)
= 14,301 kg.

The problem of a governor bell is equally simple in metric measures and equally complex in ours.

In calculations regarding liquors, the comparison is still more favourable. The liquor well area being known, and the specific gravity of the liquor having been ascertained by Twaddel or Beaumé, the depth is measured with a 3-metre dip-rod, and we have:

$$\left.\begin{matrix}\text{Liquor contents}\\ \text{in metric tons}\end{matrix}\right\} = \left\{\begin{matrix}\text{Area o. well}\\ \text{square metres}\end{matrix}\right\} \times \left\{\begin{matrix}\text{Dip of rod}\\ \text{metres}\end{matrix}\right\} \times \text{specific gravity.}$$

In determining ammonia contents [*vide* Newbigging's Handbook], there is no complication of ounces per gallon, &c. A sample of 10 cubic centimetres (10 c.c.) is titrated with normal acid and the free ammonia found thus: Free ammonia (kilograms NH_3 per 100 kg. of liquor) = acid used (c.c.) × 0·017 × 10 ÷ specific gravity. Suitable correction must be made for fixed ammonia and for variations in specific gravity of liquor. The Referees' test, done with normal acid, becomes logical, and its connection with the whole ammonia section is made evident.

Another important point is the effect of the metric system combined with the centrigrade thermometer in developing clearness of thought. They foster the habit of thinking in calories per cubic metre, and thereby making rapid mental comparisons of gas-engine performances, of fuel values of tar, and grasping the real meaning of efficiency in carbonizing operations. It is convenient to note that B.Th.U. per cubic foot × 8·9 = calories per cubic metre. The co-efficient 8·9 arises from 100° C. being equal to 180° Fahr., and the kilogram being 2·2 lbs. and the cubic metre containing 35·3 c.ft. (100 × 35·3) ÷ (180 × 2·2) = 8·9.

As against these great advantages accruing during the work of every day in the years to come, we have to reckon the non-recurring disadvantages of having to alter the gas indexes. The cost will be considerable; but most gas companies will be glad of the opportunity to overhaul all their meters and exclude those which are very old or too small for their work.

Under the metric system the only other appreciable item of cost will be the re-marking of weighbridges; and it is to be hoped that the use of weights will be extended to the exclusion of all sales by measure. Where they persist, we shall use the hectolitre—nearly 3 bushels; so that the chaldron of 12 sacks will remain almost unaltered.

With our coinage also decimalized we may expect to see coal or coke invoiced thus: Wagon No. 488,615. Gross, 21,540 kg.; tare, 8840 kg.; net, 12,700 kg. 12,700 kg. at £3·225 per ton (of 1000 kg.) = £40·957.

The amount of the bill would probably be written in three columns as at present; and being 40 pounds 9 florins 57 mills, it would then appear as £40/9/57.

Wages Dispute at Harrogate.—A threatened strike of employees of the Harrogate Gas Company was happily averted. The men had asked for an average increase of £1 per week; but it was pointed out to them that this would nullify any benefit which might be received from the reduction in the price of coal by 10s. a ton. The management also informed the men that a national arbitration was shortly to commence. Learning this, the men decided to withdraw their demands and will stand by the result of the national arbitration.

CONTINENTAL UNION GAS COMPANY, LIMITED.

Price of Coal to our Allies.

The Ordinary General Meeting was held last Tuesday, at the London Offices, No. 7, Drapers' Gardens, Throgmorton Street, E.C.—Colonel H. LE ROY LEWIS, C.B., C.M.G., D.S.O., in the chair.

The SECRETARY (Mr. Edwin C. Bode) read the notice convening the meeting, and the report and accounts were taken as read.

A GLANCE AT THE ACCOUNTS.

The CHAIRMAN said he was now going to move that the report and accounts be received and adopted. Before doing so, he should like to make some remarks on the business of the Company for the twelve months now under review. When he had the honour of addressing the proprietors a year ago, they would no doubt remember that the accounts then covered a period which had been entirely absorbed in war activities. The accounts which they had now to review for the year ending on June 30 still included four-and-a-half months of war. Therefore, they could hardly say the accounts had yet reached a normal position; but when they were likely to do so he should hardly like to prophesy. He could not congratulate the proprietors on the accounts this year. The Directors had tried to keep the ship floating; and he thought that, on the whole, they had not done so badly. He should like to draw attention to a few of the items in the accounts. The management and general charges were slightly less this year, owing to the repairs account for the London office being slightly smaller. Pensions in London and Messina were a little larger, because a London pension, which was payable during a few months last year, was payable over the twelve months of this year, and also because the Italian exchange under which they had to remit money to Italy to pay their Messina pensions was much against them this year. Income-tax this year was smaller, because they had to pay, he was sorry to say, on a smaller sum of money than they received last year. They had certain liquid assets last year which had disappeared this year. Therefore, they had not had quite so much money coming in. The dividends and interest received during the year were a little less—the amount of interest which they drew on liquid assets no longer figuring there. The income-tax refund (as would be seen on the credit side of the profit and loss account) was larger. This was owing to the fact that the refund for management expenses was always limited to what would have been the relief if the tax had been payable on a three years' average. Last year the average was less than the claim, and the refund was consequently reduced. This year the full claim was allowed. In the balance-sheet on the debit side would be seen sundry creditors and credit balances; and on the credit side cash at bankers, loans, &c., varied considerably. This was entirely due to the fact that they had much less of the Union des Gaz money with which to meet the freights and coal purchases here this year. Finally, he came to the profit and loss account, which this year showed a credit of £9672, which, of course, was the net revenue for the year, added to the balance of £5893 which had been accumulated at the end of the previous year. The net revenue in the preceding year was £3846. The net revenue this year was £3779—within a few pounds of the same amount.

NO DIVIDEND.

The Directors proposed to carry the balance forward, and to make no distribution for dividend. He thought that, on the whole, the proprietors would approve of the policy of the Board in this respect. When they came to reflect, they would see that the £3700 which had been earned during the year—if they were to distribute the whole of it—would only amount to a dividend of about 0·33 p.ct. on the entire capital; and if they were to distribute it up to the hilt on the preference shares, it would only mean a distribution of 1¼ p.ct. on these shares. In view of the fact that the position was extremely uncertain, and that they had very grave causes for anxiety in their undertakings abroad, and that their capital account probably suffered very serious depreciation at the present moment, the Directors did not think it advisable to make any distribution of dividend. He felt certain, when the proprietors considered all these facts, they would agree with him that it was better to keep their assets liquid, although not very large ones. During the year at various times he had received letters from stockholders, who asked him why no dividend had been paid. These, he presumed, were stockholders who did not pay much attention to the affairs of the Company; but, seeing that their bankers were unfortunately not crediting their accounts with the sums they used to do, they wrote these letters. Such letters were not pleasant reading. He could quite imagine that very often the letters came from homes where the lack of the dividends that used to be received from the Continental Union Gas Company made themselves seriously felt. He should like to say here that he hoped the stockholders who had written to him would do him the honour of reading what he had now to tell them.

AN EXPLANATION.

There was one reason, and one reason only, why the Directors were not in a position to pay dividends in these times. It was that their investments abroad, which consisted (as they all knew) of a large holding in the shares of the great French Company, the Union des Gaz, had been for some time past totally unremunerative. They had eight-tenths of their capital engaged in the Union des Gaz. Before the war, they used to receive as income from that great undertaking an amount, roughly speaking, of about £60,000 a year. They were *minus* this sum now. And this was the reason, and the only reason, why they were not in a position to pay any dividend.

OVERWHELMING DIFFICULTIES—GAS AT 70S. PER 1000 C.FT.

He should like to draw attention to the nature of the difficulties the Union des Gaz had to face at the present moment in its operations on the Continent—very largely in Italy; for as the proprietors perhaps knew, the large towns of Milan and also Genoa were supplied with gas by that Company. The difficulties that were met with in the exploitation of any industry on the Continent were at the present time simply formidable—it was no exaggeration to say they were gigantic. Badly off as they might be in this country, anxious as the times might be, they were mere fleabites to the troubles the Continent of Europe had to endure at the present moment. Only that very morning he received a letter from a large town in Central Europe of which his correspondent was the local manager of the gas-works. He informed him that the price of gas in the town had been raised to 70s. per 1000 c.ft.—7s. per 100 c.ft.—which was a gigantic price. When they came to think that the people in these towns had no other means of cooking their dinners—coal and wood being very often completely unobtainable—they could imagine what a fearful tax that was, and what a terrible ferment and discontent such prices produced in the minds of the labouring population. In the different countries, the Union des Gaz had contracts which were, of course, made a long time before this disastrous war; and these contracts prescribed the sale of gas at a very low price indeed. Under the original contract in Milan, they sold gas at 13 c. per cubic metre—a very low price. This had since been raised to 27 c.; but this was a totally inadequate price. So what happened to the Union des Gaz at this station, and, in fact, at all of their stations, was that the labouring class saw the price of everything rising. They then became discontented, and struck for higher wages. The Directors perfectly recognized the justice of their attitude; and they were quite willing to grant the rises. But, of course, they could not possibly ruin the Company by granting demands which it would be impossible to finance satisfactorily. Therefore, the Company asked for an increase in the price of gas. Long negotiations took place with the Municipal and State authorities; and in the end, in several towns they obtained satisfaction for their demands. But there was always, of course, an awkward period—an interregnum—and during several months they were losing money very heavily indeed. This was practically what happened at every station the Union des Gaz had anything to do with. There was another difficulty the Union des Gaz had to face, which made it impossible to see how things stood. It was that the accounts could not be made up. The Directors of the Union des Gaz last year presented a sort of rough, approximate balance-sheet. But it was not anything like accurate; nor could it be until the accounts in Italy were liquidated. During the war there was a peculiar state of things prevailing in Italy. The Italian Government granted gas undertakings a guarantee against loss. They established a system called pareggio. By it a gas company neither made profits, nor did they lose. The State guaranteed them against loss; and if there were any profits, the State was to take them. The accounts naturally had to be approved by the State; and it was impossible to get their approbation quickly. A Commission was sitting at Rome before which the Company were represented; and they hoped in the course of some months—perhaps he might say very many months—to get their accounts through. Until the accounts were approved, it was impossible to make out a profit and loss account for the Union des Gaz; and therefore they could not say whether they had been working at a profit or at a loss. He was only instancing this as one of the many difficulties—and it was quite a minor one—that the Company had to meet.

PRICE OF COAL TO OUR ALLIES.

Really the greatest difficulty they had to face in the Company was the exorbitant price they had to pay for the raw material of the industry—coal. The history of coal in this country was not a pleasant one. He had been reading that day of some unfortunate minister who said the whole of their domestic politics might be summed up in the word "Coal." Certainly, so far as the Board were concerned, the whole of their activities had been directed towards getting coal, and at as reasonable rates of freight as they could, in order to send out the raw material to the stations of the Union des Gaz. All through the years 1917, 1918, and up to June 1 this year, the price of coal was controlled in this country; and really they did not do so badly. In 1917, the price of coal was 25s. per ton controlled to our allies. He drew particular attention to this point—"to our allies." In 1918, the controlled price was 32s.; and up to June 1 of this year, it was still 32s. At that time, when the price was controlled to the allies, it was practically uncontrolled to neutrals—a very just measure, he thought, and one he should like to see continued. So, while our allies were paying 32s., neutrals were paying 57s., and even more up to end of last May. As neutral countries had been making money hand over fist out of this country, there was no reason why they should not pay more for coal. On June 1 this year, the control was taken off the price of coal for export purposes. From that time the price seemed to have taken a vertiginous course; and so at the present time as much as 90s. per ton was being paid in order to send coal to our faithful allies—France and Italy, while neutrals were now only paying some 5s. to 10s. more. He did not know how this struck the proprietors; but he was bound to say, if some measure could have been found whereby less relief had been given to domestic consumers here, and a greater imposition of burdens had been made on the neutrals, so that our allies could have obtained coal at a more reasonable rate, he thought this would have been better for everybody concerned. As it was now, they saw, on the one hand, a wish to do everything to help France and Italy to recover their positions in the world—positions which were more than sadly shaken—and, on the other hand, an action taken in regard to coal which was disastrous to the countries concerned. If the proprietors knew as intimately as he did the condition of affairs both in France and Italy, they would be seriously alarmed for the future of these countries. Conditions were not good in this country; but in course of time, the difficulties would be surmounted, and the storm would be weathered. France might perhaps weather the storm. But he thought the state of affairs in Italy was very dangerous indeed; and it was doubtful to him whether she would ever pull through without a frightful financial crash. This was the moment England chose to impose this enormous tax upon the raw material of industry. It was not as if coal was an article that, if put at a high price, the would-be purchasers could say: "We will not buy it, because you charge too high a price." It was an article those countries must have in order to reinstate their industries, and to get themselves working again on a sound financial basis.

COAL AND EXCHANGE.

He saw in "The Times" only that morning that Lord Gainford had stated that it was absolutely necessary for this country, in order to get exchange on to a sound basis, to charge a high price to foreigners for

coal. What his Lordship exactly meant by this he could not say, because, far from putting exchange on a satisfactory basis, these high prices for coal only stereotyped the terrible conditions of foreign exchanges. Up to quite recently the foreign exchange on France was up to 45; it was 42 that day. The Company received remittances that morning from Italy. The rate of exchange was 50·45. Of course, charging a high price for a commodity made conditions of affairs infinitely worse, because it required more lires and more francs to pay for the export of coal than it would do if the exchanges were lower. Thus it produced greater demands for bills on England in those countries. How they could possibly get out of raising the foreign exchanges if they charged exorbitant prices for their commodities, and bought nothing whatever from foreign countries, it passed his mental vision to be able to understand. To show how serious the exchange position was for the Company, he need hardly tell the proprietors that the whole of the money of the Union des Gaz was made in Italy and in France; and therefore, when the Union des Gaz wished to pay the Continental Union Company in England for coal and freights, they had to remit francs and lire. They required to send over 320,000 tons of coal per year to meet the needs of the Union des Gaz; and paying, putting it at a rough average, £6 per ton for freight and coal (this was understating it considerably), it required about 2 million sterling a year. Now exchange acted in this way for the Company. Instead of having to remit, as they would have done before the war, about 50 million liras to the Company, the Union des Gaz had now to remit 100 million liras; so that it exactly doubled their burden. It would thus be seen that the condition of coal and of the exchanges made the affairs of the Union des Gaz extremely difficult to carry on.

FREIGHTS AND SHIPPING INCIDENTS.

There was another great reason for the difficulties the Company had to encounter. That was the question of freights. Freights during the war were controlled. In 1917 and 1918, they averaged about 64s. 6d. per ton to Genoa; and in 1919, 58s. 9d. But they had since gone up (he was speaking of 1919) to 80s. and 90s. So it would be seen the freight position was a very bad one. So far as the Union des Gaz was concerned, he was happy to tell the proprietors, they had been able to procure time-charters on advantageous terms. Therefore they had not had to pay anything like such high prices for freight. But it must not be imagined for one moment that, because they had time-charters, they had not difficulties in other directions. What happened? They got together a nice little fleet of these boats. One of them was recently wrecked. It was impossible to avoid that. Then the Government seized others, without rhyme or reason, and sent them to South America to fetch food. They could not resist that for one moment. But at the time of the railway strike in this country, they had two boats which were sailing—one of them with Newcastle coal for Genoa, and one of them with coal which they got from the United States. Both these boats were seized, and one was discharged at Southampton, and the other, though not discharged, was about to be, at Malta. That was on the part of the Government a very high-handed thing to do—to seize American coal belonging to a French Company intending to discharge it in an English port. He did not say it was not justified; but it was a pretty stiff action. The Company were claiming damages from the Admiralty for these actions.

BETWEEN OPTIMISM AND PESSIMISM.

With these difficulties of coal, of freights, and of exchange, combined with the conditions of affairs in the countries of Europe, the lot of the Union des Gaz was not a very promising one. All the future of their Company was practically wrapped-up with the future of the Union des Gaz. If it did well, the Continental Union Company did well; if it did badly, the Company did badly. At the present moment—it was no use blinking the fact—the fortunes of the Union des Gaz were not at a very high ebb. It was possible they might pull through unscathed, and see a period of prosperity such as they used to have. But he did not wish any stockholder to go away from the meeting with any undue optimistic ideas. The condition of affairs both in France and Italy was serious. It was certainly not by issuing a French loan in London that they would set the French nation on its legs again He had great faith in the French. They were an industrious, hard-working, brave, and honourable nation. He was not at all sure that, if they were given the time and opportunity, the raw materials, and above all cheap coal, they might not be able to pull themselves on their legs again. But the Italians were in a bad way—in a bad way financially and politically; and whether Italy would ever pull herself out of this crisis was, he thought, at any rate doubtful. He did not wish to be unduly pessimistic, or to send the proprietors away that day feeling gloomy. But he had tried to put before the proprietors as fairly and dispassionately as he could the seriousness of the position of the Company. He felt certain the proprietors would sympathize with the Directors, who carried this burden, which was by no means light. He formally moved the resolution for the adoption of the report and accounts.

Sir HENRY BIRCHENOUGH, K.C.M.G., seconded the motion.

Mr. C. P. CROOKENDEN thanked the Chairman for his most interesting speech.

Mr. CAVE ORME asked whether the Chairman had anything to say about the Strassburg property?

Mrs. JOHN remarked that, from what she had read, new sources of coal had been found in the far North [? Spitzbergen]; and, according to the statement in the papers, it appeared that this coal could be supplied at a much lower cost than that at which coal could be purchased here. She did not see why the Company should not make a contract for coals (when available) from this new source.

The CHAIRMAN said they had a ray of light; and it came from a lady. It was the first he had heard for a long time of "cheap" coal. If it was possible to get cheap coal, they would buy as much as ever they could. Mr. Cave Orme had asked him a question about Strassburg. That was another bright ray of light. When the Germans evacuated Strassburg, their undertaking was restored to them; and they naturally felt satisfaction. The Germans had behaved very badly to them during the war. They not only sequestrated the Company, but they changed the management and the Articles of Association, and did all they could to damage them. But when the Germans went away, they forgot the cash in the till. They left about 3 million marks there. This money was valoirized by the French Government at 1·25 frs. for the mark. So they would get all the money back again. The Strassburg undertaking was doing pretty well indeed at present. It was a separate Company now. It had presented its report and balance-sheet; and it had made quite a good little profit.

Mr. H. J. SOLOMON asked whether the Strassburg concern belonged to the Union des Gaz or to the Continental Union Gas Company.

The CHAIRMAN replied that it was the Union des Gaz property formerly; but when they got a prolongation of the concession, they went into partnership with the town.

RE-ELECTION OF DIRECTORS AND AUDITORS.

Sir JAMES REMNANT, BART., M.P., said, on behalf of the proprietors, he should like to have the pleasure of moving the re-election of the two retiring Directors—the Chairman and Sir Henry Birchenough. In doing this, he wished to offer to the Board the sincere congratulations of the proprietors upon having so far pulled the Company through a difficult crisis, and to assure them that they had the utmost confidence of the proprietors, who had no fear that, whenever opportunities occurred in the future to help the Company, the Directors would immediately avail themselves of them. No other Board could have done better than the Directors had in the interests of the Company, and very few could have done anything like so well.

Sir ARTHUR LUCAS (Deputy-Chairman) seconded the motion with much pleasure. Sir James had proposed the re-election of the Chairman and Sir Henry Birchenough much better than he (the Deputy-Chairman) could have done. The way the Chairman had put the affairs of the Company before the proprietors proved how fully cognizant he was of all the details of the business; and he had shown that he was not going to paint in rosy colours anything that was not the subject for a bright picture. In re-electing both these gentlemen they would be doing a wise thing, in the very difficult circumstances of the Company.

The motion was heartily carried.

The CHAIRMAN having sincerely thanked the proprietors on his own behalf and that of Sir Henry Birchenough,

The Auditors (Mr. A. T. Eastman and Mr. C. P. Crookenden) were re-appointed, on the motion of Mr. CAVE ORME, seconded by Sir JAMES REMNANT.

A VOTE OF THANKS.

The CHAIRMAN moved a vote of thanks to the staff both in London and abroad for their services. He did this with very great pleasure. Few people knew what an enormous amount of labour, care, devotion, and energy was shown by the staff in the execution of their duties. They had in Mr. Bode, their General Secretary, an official who naturally spurred one on to action. He was afraid he was a rather unreasonable Chairman. He wanted a lot of facts and figures. Mr. Bode never grumbled, and never blew him up. In their staff abroad, they were extremely lucky. They had a variety of very high-class officials; and more especially should he like to refer to Commandant Gruss, who had the care of the Italian stations. If there was a man who would pull himself out of a difficulty, it was certainly this officer; and he devoted the whole of his time, care, and energy to the pursuit of the interests of the Company.

Mr. CAVE ORME seconded the motion, which was cordially agreed to.

Mr. BODE on behalf of himself and colleagues at home and abroad, thanked the Chairman for his kind words, and the proprietors for their endorsement. During the many years he had served the Company—now something like 44 years—he had tried to do his best, and would continue in the same spirit to the end.

POWER GAS CORPORATION.

Annual Meeting.

The Annual Meeting of the Corporation, which was held in Manchester last Thursday, was presided over by Mr. E. Lloyd Pease (the Chairman), who said that there was a profit of £33,561, as compared with £26,899 for the previous year. There was one side of the business in which an increased amount of work had been carried out—the manufacture of compact and comparatively small gas plants for producing gas for manufacturing and power purposes. These plants provided the manufacturer with simple and cheap means by which to produce his own gas for heating and power where his requirements were not very large. The existing conditions, while unfavourable to big undertakings, involving the extraction of bye-products, were quite favourable to the adoption by smaller industrial works of self-contained plants involving only a small outlay. The chief reason for this was in the great increase in the cost of town gas and of fuel generally. When town gas was less than half the present price, the manufacturer was content to use it without adding a gas plant to his appliances; and when coal was at a lower price, he was content to use it rather than use gas, even if more economical.

Turning to general topics, the Chairman proceeded as follows:

THE ELECTRICITY BILL.

To a company like the Power Gas Corporation, identified with the supply of power, the present position of the question of cheap power and the proposal to erect super-stations with their attendant limitation to freedom of action contained in the Electricity Bill, is a subject of special interest. It is rash to be dogmatic in engineering matters, but at least it may be said that there is a widely-spread feeling that the present is not a favourable one for engineering experiments on a larger scale. It will be remembered that it was recently stated in the House of Lords, when the Electricity Bill was last under discussion, that the sixteen proposed super-stations would cost not less than £150,000,000, and that at the same sitting Lord Moulton drew attention to the serious danger arising from the fact that whole districts could be instantaneously paralyzed by the action of an ill-disposed person or clique if this system of gigantic concentration were carried out. To many per-

sons, it would appear, on consideration, that such an expenditure and such a risk would be only justifiable if great economy were certain to be realized.

THE QUESTION OF FUEL CONSUMPTION.

The view has been expressed by several well-known authorities that, while capital outlay on large central electric supply stations would be justified for the supply of power to railways and for electrolytic processes, to regard them as the best means of electric generation for universal requirements is an entirely mistaken view. My remarks are confined to the super-station in its relation to the ninety-and-nine general consumers of heat, light, and power. Sir Dugald Clerk estimates that the services rendered by the 40,000,000 tons of coal now used per annum for heating and cooking could, in up-to-date gas-works, be rendered by 20,000,000 tons, while it would require at least 60,000,000 tons of coal consumed in super-stations to provide equal services. This is supported by Prof. J. W. Cobb, who has stated that "the combined heat efficiency of the gas-works and the gas-fire is approximately 50 p.ct., as against 13 p.ct. for heat efficiency obtainable from electricity, even when the promised efficiency of the super-station is obtained."

My text at the moment is the utility of small individual gas power and heating plants, and not that of municipal gas-works; but I have quoted these statemnts to establish the fact that there will be an abundant supply of suitable fuel for such small plants. Their most suitable fuel is coke or anthracite; and it is obvious that gas-works are not going to be rendered effete by super-stations, but will be in the future great producers of coke.

GAS V. ELECTRICITY.

The position of the ordinary citizen and of the manufacturer can be easily visualized by the following figures: If a ton of coal is passed through a gas-works, it will give the citizen 12,000 c.ft. or more of gas for light and heat, and also about 20 lbs. of sulphate of ammonia, a sufficient amount of fertilizer for a quarter-of-an-acre, as well as tar and oils, and in addition about 10 cwt. of coke. If he is a manufacturer, on purchasing the coke at a profit to himself as a ratepayer, he can obtain therefrom about 1000 H.P. hours of electric energy or gas for heating purposes. A similar ton of coal passed through a super-station would produce about 1500 H.P. hours for delivery, and nothing more. This is certainly an increase of 500 H.P. hours from the ton of coal; and the claim on behalf of the super-station is that he will obtain the 1500 H.P. hours at so low a figure that it will pay him handsomely to buy it rather than make it for himself, both as a manufacturer and as a householder, though a citizen owner of gas-works. But this is far from being the case. Assuming that, under high cost conditions and his variable load, the manufacturer has to pay 1d. per H.P. hour, and takes half the product of a ton of coal in power and the balance for home consumption in the form of electricity, he is a heavy loser on the transaction, as a comparison shows. On the assumption that a ratepayer uses all the electric power from 1 ton of coal sent out from a super-station, one-half in his house and one-half in his works, the following is an approximate estimate of the financial results.

COMPARISON OF COST FIGURES.

He will obtain for heating and lighting the heat equivalent of current amounting to 750 H.P. hours, or (say) 2,000,000 heat units, which at the assumed rate of 1d. per H.P., will cost him £3 2s. 6d. On the power side he will pay £3 2s. 6d. for the remaining 750 H.P. sent out by the power station from 1 ton of coal. On the other hand, if he consumes the gas from 1 ton of coal at home, and relies on the resulting coke for power, he will get approximately 12,000 c.ft. of gas (say) 6,000,000 heat units for £2 8s. if the charge for gas is 4s. per 1000 c.ft. If he uses the coke left after the extraction of the gas and products, he will be able to produce from the 10 cwt. saleable by the gas-works 1000 H.P. hours at a cost of about £3, assuming coke at £2 per ton, and including interest and depreciation of engine, gas plant, and working expenses. The combined result is that, as a customer of the super-station, for a payment of £6 5s. he will obtain 750 H.P. hours and 2,000,000 heat units. Alternatively, as a customer of the gas-works, he will get in return for an expenditure of £5 8s., or for 17s. less outlay, 6,000,000 heat units and 1000 H.P. hours. These figures are put forward as being illustrative, and not as scientific data. They approximately indicate that, when town gas and coke or anthracite can be obtained, heat from gas will cost about one-third and power from coke about three-quarters, of the cost of similar services from a power station. While presenting this case for small gas plants as power generators, I have no wish to criticize the super-station proposal, but merely to obtain for decentralized sources of supply fair consideration.

The report was adopted, and a dividend at the rate of 6 p.ct. per annum, less tax, was declared.

Gas-Workers' Strike at Aberavon.—Gas-workers at Aberavon and Margam struck work on Friday evening, claiming time-and-a-half for Saturday afternoon and double time for Sunday work. There was then only sufficient gas supply in stock to last for twelve hours. The strikers, at the request of the union leaders, returned to work at five o'clock on Saturday evening, and agreed to continue over the holidays, pending some satisfactory settlement.

Skegness Gas-Works Purchase Payment.—The question of the borrowing of the sum of £44,000 for the purchase of the gas undertaking was again discussed by the Skegness Urban District Council last week. The Clerk reported an unsuccessful endeavour to arrange for a temporary loan from the Council's bankers; and the best offer was that of a Mr. James Boyce, who asked £5 17s. 6d. p.ct. interest on a 35 years' repayment basis. Mr. Marshall said the interest was terrible, and, together with the capital repayment, would constitute a great burden on the ratepayers. It was stated that the liquidator of the old Gas Company was strongly pressing for the matter to be cleared up, and that several shareholders were badly in need of their money. It was finally decided to close with Mr. Boyce, conditional on his agreeing to a clause that the Council could pay off the whole amount at six or twelve months' notice. Otherwise the Council will again discuss the position.

LOW-TEMPERATURE CARBONIZATION, LTD.

The following "Official Report" has been published of the annual meeting of the Company, which took place on Monday of last week at Nos. 14-16, Cockspur Street, S.W.

The MANAGING-DIRECTOR (Mr. H. L. Armstrong) said: On joining the Board on March 31 I proceeded to make an examination of the Company's plant and process. As you well know, by our patented process we virtually double the value of a ton of coal, as 1 ton of coal carbonized by our low-temperature methods will do the work of 2 tons of raw coal. This remarkable result is explained when we consider the products we obtain. From every ton of coal, at one and the same time, we get:

(*a*) 3 gallons of motor spirit;
(*b*) 16 gallons or more of oils for burning, lighting, and lubricating;
(*c*) 7000 c.ft of gas of 600 heat units per c.ft. after removal of light oils;
(*d*) 20 lbs. of sulphate of ammonia;
(*e*) 14 cwt. of smokeless fuel.

The working cost of our process is less than that of other established carbonizing methods, and the capital cost of the plant is less.

The Board decided that, before commencing new constructional work, the engineering and chemical research staff of the Company should be reorganized, and that the Company's plant near Barnsley should be operated with a view to instructing the new staff fully in its work; and also to modernize the plant and perfect all mechanical details.

The Barnsley plant was operated from April to September, and the results obtained were such that the engineering staff were able to report to the Board on Sept. 15 that the claims made in the past for the Company's process were fully justified.

IMPORTANT CONTRACTS SECURED.

In view of this conclusion, we commenced negotiations for several large schemes to erect plants as soon as industry had settled-down. A contract has now been arranged with an electric power company in Yorkshire to erect a plant and supply all the gas that can be made from the carbonization of 500 tons of coal per day. This gas is to be burnt in the power company's boilers in place of raw coal, and since the electric company in question is one of the foremost in the country, and supplies its electric power at a very low rate, we are actually offering to supply it with gas at a price which shows a great saving over coal. It is not necessary here to go into the merits of the use of gas instead of coal for boiler-firing; but we can assure you that through this contract a great industrial awakening is foreshadowed.

Negotiations were then begun with an influential group of manufacturers situated in a great industrial district in Scotland, the object being to provide enormous quantities of power gas for burning under boilers in place of coal; and our process lends itself so well to this scheme that it immediately found favour with the parties interested. Assurances have been given that consumers whose aggregate consumption is 4000 to 5000 tons of coal per week will purchase gas from a super-carbonizing station operated on our process as soon as erected. We are now getting out a plan by which this scheme can be worked on co-operative lines, whereby consumers will be shareholders in the Company.

Negotiations are also practically complete for the erection of a plant to carbonize a minimum of 500 tons of coal per day near Sheffield.

Although in all these schemes the only arrangements are those which have been made to sell the gas, large quantities of motor spirit, oil, smokeless fuel, sulphate of ammonia, chemicals, &c., will also be made and marketed. Work on the plants is expected to start next year, and will in all probability be handled by subsidiary companies.

We have modernized and redesigned our plant at Barnsley; and the erection of a complete unit with several important patentable modifications will be completed early next year. This unit is for the power company in Yorkshire, and will supply gas to their boilers.

The above statement indicates the growth of industrial interest in connection with low-temperature carbonization; and we are convinced that this is the beginning of a national movement of far-reaching results to the Company and country.

A Statement of the Coal Position at Hastings.

In an announcement upon the coal position to the consumers of the Hastings and St. Leonards Gas Company, Mr. C. F. Botley (the Engineer and General Manager) says the reduction announced by the Government in the price of coal used for domestic purposes creates a position of much complexity and uncertainty. It is understood that coal is to be supplied at under the cost of raising; the deficit being made good by the Treasury or from the profits on exported coal. It is the policy of the Company, as well as the object of the sliding-scale, to supply gas at the lowest possible price; and if, therefore, this new proposal really results in cheaper coal, the price of gas will be adjusted as from the Christmas readings of the meters. At present it is not possible to gauge the position properly; and a definite announcement must therefore be postponed. Consumers are reminded that there are many factors affecting the price of gas. The present price of 5s. 6d. per 1000 c.ft. (with the prepayment meters much underset) anticipated ameliorating conditions, and is not remunerative—the cost of coal and labour being in excess of the estimates. The price of coke, which is under control, and has some relation to the price of household coal, affects the question. The Company's railborne coal has been substituted by seaborne Durham; and present sea freights show no signs of reduction, but rather the reverse. The cost of the transport of coal is over three times what it was in 1914. Other possible increased costs have to be taken into consideration. For instance, in January an increase in railway freights is probable.

Universal Burners, Ltd., has been registered, with a capital of £100,000 in £1 shares. The office is at Imperial Buildings, Ludgate Circus, E.C.

OFFICIAL REPORT ON THE BENZOL ROAD TEST.

Excellent Results from Standard Specification Benzol.

There has now been issued by the Automobile Association and Motor Union their official report on the 10,000-mile benzol road test carried out on a 16 H.P. water-cooled "Sunbeam" engine, and the 5000-mile test carried out on a 4 H.P. air-cooled "Triumph" motor cycle and side car.

Early in 1919, it was found that much benzol of bad quality was being marketed to the detriment of the motoring community and to the detriment of benzol as a fuel. The Automobile Association approved a standard specification for benzol, which is as follows:

1.—Specific gravity 870 to 880.
2.—Distillation test (by flask):
Benzol shall give a distillate of not less than 75 p.ct. at 100° C.
" " " " 90 p.ct. at 120° C.
" " " " 100 p.ct. at 125° C.
3.—Sulphur. The total sulphur shall not exceed 0·40 p.ct.
4.—The benzol shall be entirely free from water.
5.—Colour. Water white.
6.—Rectification test. 90 c.c. of the sample shaken with 10 c.c. of 90 p.ct. sulphuric acid for five minutes shall not give more than a light brown colour to the acid layer.
7.—Benzol shall be entirely free from acids, alkalis, and sulphuretted hydrogen.
8.—Benzol shall not freeze at 7° Fahr. (25° of frost).

The specification was accepted by the great majority of the benzol producers, who to-day form part of the National Benzol Association, and was subsequently fully endorsed by all other motoring organizations.

The test to which the report refers was undertaken to prove whether benzol conforming to the above specification did or did not injure the engine or any other part of the car. The test and report only apply to benzol guaranteed by both the producers and the retailers to comply with this specification.

THE 10,000 MILE TEST.

During the test, samples of benzol and lubricating oil were taken and sent for analysis to Dr. Harold G. Colman.

The test began on Aug. 28, and was completed on Nov. 5, the number of days on which the car was running being 62, and the actual mileage covered 10,000·45 miles. The following results were obtained:

Total number of gallons used during the test—406 gallons 7 pints.
Average mean weight of car—1·8 tons.
Average miles per gallon—24·57.
Average ton-miles per gallon—44·22.
Total amount of lubricating oil burnt—5 gallons 6 pints.
Average number of miles per gallon of lubricating oil burnt—1739·13.
Highest miles per gallon—27·71, over a distance of 145·5 miles.
Lowest miles per gallon recorded—18·56, over a distance of 129·98 miles.
Highest ton-miles recorded—50·80, over a distance of 128·04 miles.
Lowest ton-miles recorded—33·60, over a distance of 129·98 miles.
A fair average touring speed was maintained throughout the run; and it is estimated that the average miles per hour may be taken approximately at 23·46.

The test was carried out under ordinary touring conditions. No special routes were picked.

The benzol used was supplied by the following members of the National Benzol Association: The Gas Light & Coke Company, the Staveley Coal & Iron Company, W. Butler & Co., the Staffordshire Chemical Company, and Bolckow Vaughan & Co. By far the greater number of samples complied fully with the approved specification.

The fuel tank was supplied with the standard gauze filter; and a large funnel, also with gauze filter, was used, together with a piece of chamois leather.

Reporting on the lubricating oil, Dr. Colman says that in none of the samples taken throughout the run was it possible to detect the presence of any benzol in the oil. A large amount of the final sample left in the crank-case at the end of the run was taken; but here also no benzol could be detected in it. In none of the samples could free acid be detected in larger amount than that present in the original samples of the fresh oil put into the crank-case.

With regard to the carbon deposits from the pistons and valves, Dr. Colman says these consisted partly of oil, partly of solid carbonaceous deposit, and partly of mineral matter. The mineral matter consisted partly of road dust drawn in with the air into the cylinders, and partly of oxide of iron or iron. He does not think this last was due to corrosion, but simply to abrasion of the piston and cylinder from normal wear. The deposit in the autovac at the end of the run appeared to consist mainly of dirt and scale from the cans. The weight was 0·506 gramme, or 7·8 grains. The deposit on the gauze filter between the autovac and the carburettor was an extremely small amount, weighing only 0·002 gramme, or 0·031 grain. Under the microscope it was seen to consist of a felted mass of fibre.

As to the discoloration of the copper alloys in certain parts—*e.g.*, in the float and float chamber—Dr. Colman remarks that the weight of deposit on these was too small for analysis; but he thinks it was mainly due to oxidation, and not to sulphide. It was readily removed by very dilute acid, as one would expect to be the case if it consisted mainly of a thin film of oxide of copper. The copper petrol-pipe, on cutting, proved to be as sound as on the day it was put in; and the inner surface did not appear to have undergone the slightest alteration.

On completion of the test, the engine was dismantled and inspected; and the satisfactory condition of the different parts, as already referred to in the "JOURNAL," is set forth in the report. The wear of the

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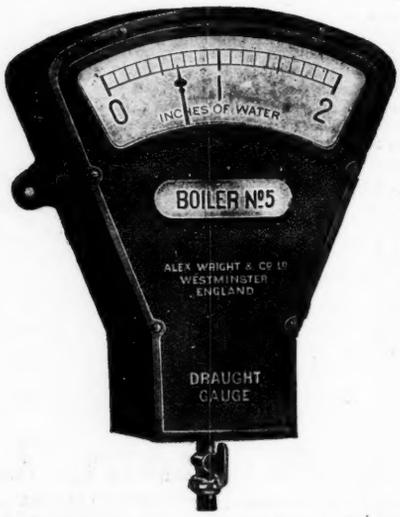
DEAD BEAT INDICATORS

instead of WATER-TUBE GAUGES and

"READ THE PRESSURE BY THE POINTER."

No liquid to evaporate and no levels to adjust.

No glasses to break and nothing to clean.



Direct reading, Open scale, Any range (Pressure, Vacuum, or Combination).

Incorrodible, Accurate, for foul or purified gas.

MADE IN MANY RANGES WITH TABLETS LETTERED AS DESIRED.

ALEXANDER WRIGHT & CO., LTD., WESTMINSTER.

Agents: Australia—FYVIE & STEWART, 360, Collins St., Melbourne; Canada—W. P. ROPER, 502, Merchants' Bank Building, Montreal.

frictional surfaces throughout the motor was in all respects strictly normal.

THE 5000 MILE TEST.

The test began on Sept. 11 and was completed on Nov. 5; the number of days on which the motor cycle was running being 49, and the actual mileage covered 5029·9 miles.

The following results were obtained:

Total number of gallons used during the test—59 gallons 7 pints.
Average mean weight of motor cycle and sidecar—836 lbs.
Average miles per gallon—84.
Average ton-miles per gallon—31·34.
Total amount of lubricating oil burnt—4 gallons 2½ pints.
Average number of miles per gallon of lubricating oil burnt—1166.
Highest miles per gallon—109·6, over a distance of 137·1 miles.
Lowest miles per gallon recorded—67, over a distance of 105 miles.
Highest ton-miles recorded—41·58, over a distance of 137·1 miles.
Lowest ton-miles recorded—24·32, over a distance of 118·3 miles.
A fair average touring speed was maintained throughout the run; and it is estimated that the average miles per hour may be taken approximately at 19·88 miles.

The conditions were identical with those of the 10,000-mile test.

The benzol used was supplied by the following members of the National Benzol Association: Robinson Bros., the Gas Light and Coke Company, the Staveley Coal and Iron Company, Baird and Co., Hardman and Holden, British Gas Company, Butler and Co.

After running for 2200 miles, the engine was de-carbonized at the Triumph Company's works. The amount of carbon deposited was stated to be about 50 p.ct. less than the average amount deposited when petrol is used. At the end of the test it was reported that, "having regard to the excessively severe nature of the test, bad weather conditions, and bad road conditions frequently met with, the engine might reasonably have been expected to have developed extreme signs of wear and tear, whereas the closest examination to which it was subjected revealed that, on the contrary, the depreciation of parts was, without exception, extremely low.

Dr. Colman was unable to detect any benzol in a sample of oil from the crank-case at the end of the run. The weight of carbon from the valve-caps, valve, piston, and cylinder at the end of the trial was 4·423 grammes; the analysis being 21 p.ct. of oil and moisture, and 79 p.ct. of insoluble carbonaceous matter.

Ammoniacal Liquor Contract at Burton.—Alderman Lowe (the Chairman of the Gas Committee), at a meeting of the Burton-on-Trent Town Council, referred to a recommendation of the acceptance of an offer for concentrated ammoniacal liquor at an advanced price on contracts in pre-war days. Owing to this, he said, the expenditure of some thousands of pounds on a sulphate of ammonia plant had been pos'poned.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 22.

All products are in good demand. Pitch is very firm, and makers' prices are well over 80s. net per ton, f.o.b. their works; but ships are very difficult to obtain. Pure benzol, toluol, and solvent naphtha are all quoted at 3s. net per gallon. Creosote is very firm at 7½d. net per gallon in bulk *ex*-makers' works. There is nothing new in the position of other products, including sulphate of ammonia.

Tar Products in the Provinces.

Dec. 22.

The average values for gas-works products during the week were: Gas-works coal tar, 43s. 3d. to 48s. 3d. Pitch, East Coast, 82s. 6d. to 87s. 6d. per ton f.a.s.; West Coast—Manchester, 65s. to 67s. 6d.; Liverpool, 65s. to 67s. 6d.; Clyde, 75s. to 77s. 6d. nominal. Benzol 90 p.ct., North, 1s. 8d. to 1s. 10d.; crude 65 p.ct. at 120° C., 1s. 0½d. to 1s. 1½d. naked at makers' works; 50-90 p.ct. naked, North, 1s. 8d. to 1s. 10d. Toluol, naked, North, 2s. to 2s. 1d. nominal. Coal tar crude naphtha in bulk, North, 8½d. to 9d. Solvent naphtha, naked North, 2s. 8d. to 2s. 9d. Heavy naphtha, North, 2s. 2d. to 2s. 3d. Creosote, in bulk, North, liquid, 6d. to 6½d.; salty, 5d. to 5½d. Heavy oils, in bulk, North, 6½d. to 7d. Carbolic acid, 60 p.ct., 2s. 3d. to 2s. 4d. Naphthalene, £18 to £22; salts, £6 to £7, bags included. Anthracene, "A" quality, 7½d. to 8d. per minimum 40 p.ct.; "B" quality, nominal.

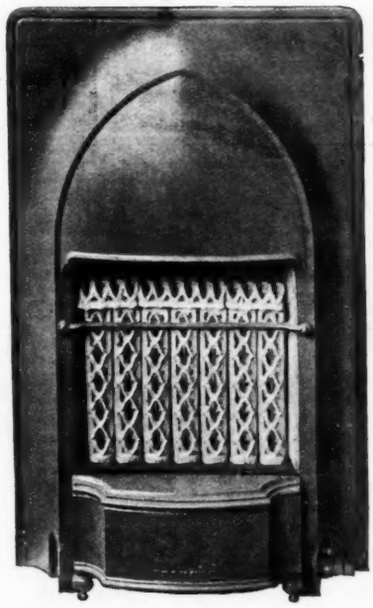
Manchester District Tar Prices.

The average price realized for tar in the Manchester district, based on the value of the products, for the month of November was £3 1s. 6·2d.

FROM A MARKET CORRESPONDENT.

Tar Products.

The approach of the Christmas holidays has been the cause of less activity in the tar product markets during last week; but there is no real change in the situation. The general strength has been maintained, with a continued tendency to a higher range of values. This is particularly the case in pitch, for which up to 90s. is reported paid for delivery f.o.b. East Coast ports. Inland Provincial rates are not much changed, and further advance seems to depend on an improvement in transport facilities, which is hardly likely yet. The London position is without change. Creosote is firm and inclined to be dearer. Solvent naphtha maintains a strong tone, although there has been no alteration in price. Carbolic acid has again developed much strength;



NEW "MAIN" FIRES.

THE new "Gothic" Gas Fires are now ready—also many other new designs. Every "Main" Fire will give daily dividends of comfort to your consumers. Don't allow the old type wasteful Gas Fires to continue in use. Replace them with "Mains," so making the most of your output and adding satisfied customers to your list for the good times ahead.

What quantity of New "Main" Lists may we send you?

R. & A. MAIN, LTD.

WORKS: Gothic Works, EDMONTON, N.18; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W. 1; 82, Gordon Street, GLASGOW; 18, Severn Street, Deansgate, MANCHESTER; 6, Narrow Wine Street, BRISTOL; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE.

and a substantial advance has to be recorded for crude 60's. This, of course, is pleasing to those who took over the Government stocks, on which a good profit is now shown. Japan is buying heavily at present; but should this outlet dry-up, there is no other to take its place just now. The future market can therefore be described as most uncertain. No crystals are available at the moment, and quotations are unreliable. Cresylic acid is much dearer. Other products are without feature.

The latest quotations are as follows:

Benzol: 90% London 2s. to 2s. 2d., North 1s. 11d. to 2s.; 50-90% 1s. 9d. to 2s. London, 1s. 10½d. North; crude, 60-65% 1s. 5d. to 1s. 7d.; pure, 3s. per gallon naked.

Carbolic Acid: Crude 60's 2s. 9d. per gallon nominal; crystals, 40%, nominally 10d. per lb.

Crude Tar: London, 50s. to 55s.; Midlands, 50s.; North, 50s. per ton *ex* works. Refined tar, 32s. 6d. per barrel (free) on rail.

Pitch: London, 85s. to 87s. 6d. per ton; East Coast, 72s. 6d. to 77s. 6d. per ton; West Coast, 72s. 6d. to 75s., with Manchester 72s. per ton and Glasgow 72s. per ton; South Wales, 75s. to 80s. per ton.

Solvent Naphtha: London, 3s. 3d. Provinces average 3s. 4d. per gallon.

Crude Naphtha: Naked, 9d.; North, 8½d. per gallon.

Heavy Naphtha: 2s. 6d. per gallon.

Naphthalene: Refined, £18 to £20 per ton nominal; crude, £6 10s. to £11, according to quality.

Toluol: Naked, 2s. 9d. per gallon nominal. North, 2s. 7d. Pure, 3s.

Creosote: London, 7½d.; North, 6½d. to 7d.; heavy oil, 6d. per gallon in bulk.

Anthracene: 40-45%, 9d. per unit per cwt.

Grease Oils: 18° Tw. (naked), £6 10s. per ton f.o.r. makers' works.

Aniline Oil: 1s. 3d. per lb.

Cresylic Acid: 95%, 3s.; 97-99%, 3s. 3d. per gallon *ex* works London, f.o.b. other ports.

Sulphate of Ammonia.

The year is ending with a very sound undertone in this material. Home requirements are substantial, and there is little to be said about exports. Small consignments continue to be sent out at prices ranging up to £28; and when to this is added the heavy rates of freight and other charges, it is obvious that, apart from loss on exchange, Continental farmers are prepared to pay very high prices for their sulphate. The Board of Agriculture calls attention to the urgent necessity of orders and delivery instructions being placed without delay for supplies needed for use in the spring. Early information as to requirements is necessary to manufacturers in order that a sufficient quantity of sulphate may be provided to satisfy home demands, and that the distribution between home buyers and exporting firms may be properly regulated.

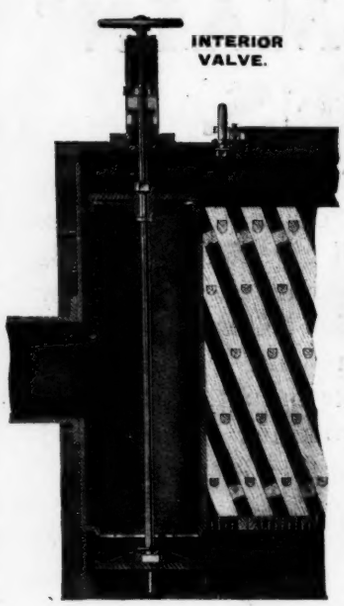
High B.Th.U. Manufactured Gas.

According to the "Gas Industry" of Buffalo, a private ownership concern is said to be seeking to sell to the city of Alliance (Ohio) a new process gas. It is stated that the minimum B.Th.U. are 320, with a maximum of 1000—thus approaching the efficiency of natural gas, which is referred to as from 725 to 1100 B.Th.U. The statement is made that the process is patented, and that the headquarters of the institution is Pittsburg. The claim is made that there is no sulphur content, and that there is no tar content. The process of manufacture contemplates either coal (bituminous or anthracite), lignite, peat, sweepings, and fine slack. It is stated that the gas may be produced for less than 35 c. per 1000 c.ft. Alliance has been a natural-gas city served from the supply that also reaches the City of Cleveland through the East Ohio Gas Company. Alliance is reduced to the necessity of doing something without delay, and will have to be cautious under this stress, since the city will naturally be the Mecca for any and all suggestions that friend and foe alike may wish to offer. The industry will watch with interest the outcome of the claims made by the promoters of this new type of gas that is asserted to provide B.Th.U. not attainable in manufactured gas heretofore. A public ballot was cast in Alliance on the subject of a municipal plant. The outcome was favourable to this end—something over $300,000 having been voted for a municipal enterprise.

Tralee Gas-Workers' Strike.—Tralee gas supply was suspended last week, owing to a strike of stokers. Only an hour's notice was given by the men, and great confusion arose in the town.

Gas Position at Accrington.—There is little change in the gas situation in the Accrington district. The question was raised at the Church Council meeting on Dec. 18, and the assurance was given that the Manager (Mr. A. J. Harrison) was doing all he could in the matter. The Coal Controller has now replied to the urgent representations, promising to give all the assistance he possibly can. It is officially stated that the authorities will be able to tide over Christmas.

Position of the Batley Gas Supply.—Batley is suffering from a shortage of gas owing to the various war and after-war effects. Local opinion puts a good deal of blame on the past short sighted policy of the Town Council devoting profits towards the rates, instead of laying up a reserve fund with which to secure renewals or extensions. The neighbouring town of Birstall is at present augmenting the supply to the extent of 50,000 c.ft. per day. There has been talk of help from Heckmondwike; but that town is handicapped by coal shortage. Mr. R. H. Duxbury, the Batley Gas Manager, is also limited in his efforts to improve matters by the inferior coal which is being delivered. It is understood that the Gas Committee have given instructions for the preparation of specifications for the installation of vertical retorts and a water-gas plant, new boilers, boiler-house, ammonia washer, &c.



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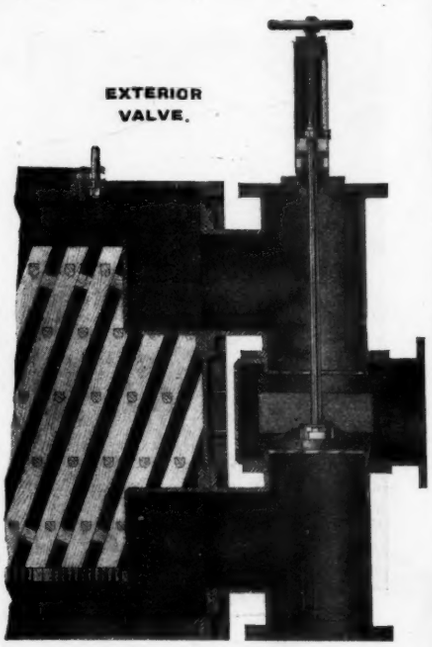

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MANCHESTER.

Gas Coal Stocks.—The "Iron and Coal Trades Review" last Friday said the position of coal reserves at gas concerns is not nearly so satisfactory as a fortnight or so ago. Many works have less than one week's supply in sight; and in some instances they are working from hand to mouth. This is a very unsatisfactory position, seeing that we are at the heavy consuming period, and in face of the holidays, when pits will stand at least three days.

Value of Good Street Lighting.—Strong evidence of the value of good street lighting is to be found in the following paragraph, taken from the latest issue to hand of the "American Gas Engineering Journal:" With street lights dimmed in an effort to conserve fuel, the reports of the Chicago police for one day included thirty-six hold-ups, twenty-eight auto thefts and safe-blowings, eight underworld leaders arrested, and the Mayor's car stolen. During this period of dimly lighted streets, the police report the greatest "crime wave" Chicago has ever experienced.

Failure of the Port Glasgow Gas Supply.—After a lengthy discussion at a meeting of the Port Glasgow Town Council on a report by Mr. R. W. Cowie (the Gas Manager) as to the failure of the supply a few weeks ago, a resolution was passed by a majority recording the Council's high appreciation of the expeditious and business-like manner in which Mr. Cowie recently dealt with the situation. In his report Mr. Cowie states that the works are, and have been for a long time, in a disreputable condition. During his experience of fifteen years as a gas manager, he never before had the supply of gas fail, but he never certainly had such plant to work with, and knew of no one who had.

Failures of Electricity in West Ham and Sheffield.—A breakdown at the West Ham Corporation's electric light station at Canning Town on Sunday evening cut off the current for about half-an-hour. The electric light plant had for some time been defective; and arrangements had been made for supplies of current from the London County Council and neighbouring authorities, so that some sections of the borough were not affected. Fortunately, many of the streets are lit by gas. In High Street, Sheffield, and some other thoroughfares, there was a failure of the electric light for a short period on Friday evening, during the busy shopping time. The official explanation was that there had been a "blow-out" of one of the fuses in the main cable.

Economizing in Electricity at Bradford.—General satisfaction was expressed, at a meeting of the Bradford Electricity Committee on Friday, with the response made by users of electricity to a request to economize, in view of the serious breakdown of the generating plant. The Electrical Engineer reported that a meeting had been held with consumers other than those engaged in the textile, engineering, and electric furnace industries, who had a demand in excess of 10 kilowatts. Those present pledged themselves to discontinue until further notice the use of electricity between 3.45 p.m. and 5.30 p.m. on Monday to Friday, after 24 hours' notice. They further agreed to economize in the use of electricity between 9.30 a.m. and 12 noon from Monday to Friday.

Increase in Private Bill Business.—The petitions for Private Bills for the 1920 session show a considerable increase on the number deposited for several years past. In 1914 there were 135 notices; whereas in the session just closing the number of Bills deposited and dealt with by Committees was 57. For the coming session the total is 120; and, in addition, plans have been deposited in respect of 58 Provisional Orders, including Scotch Orders.

Fatality Due to an Electric Heater.—An inquest has been held at St. Leonards on the body of Ellen Heathcote, who was found by her sister screaming in the middle of her bedroom with her dress on fire. Giving evidence, the sister said she thought the accident was due to an electric heater, which was in the room. A servant stated that there were no matches in deceased's room. She did not tell them how the accident occurred. Dr. Redmayne said he found deceased suffering from extensive burns. He thought electric heaters should be protected. Some part of the clothing must have come in contact with the incandescent wire. The Coroner returned a verdict of "Death from accidental burns brought about by an electric heater."

Coal and Gas Prices at Whitchurch.—The Directors of the Whitchurch (Salop) Gas Company, Ltd., have been compelled to readjust the price of gas to ordinary meter consumers for cooking, heating, and power, owing to the still increasing cost of production and distribution of gas, the fact that a large proportion of their coa had, owing to the Coal Controller's orders, still to be obtained from County Durham (180 miles away), on which the threatened increased railway freights will have a very serious effect, and the continued uncertainty as to the position of the coal supply generally. This is the first occasion the Directors have had for adjusting the prices of gas to meet the unexpected advance of 6s. per ton on coal last July, and a subsequent advance in workmen's wages.

General Licence for the Export of Coal.—The Board of Trade announce that, with a view to the decentralization of coal export control, an open general licence has been issued with effect from Thursday, Jan. 1, 1920, permitting the export of coal, coke, and manufactured fuel to all destinations abroad except Russia, Germany, Hungary, Austria, Turkey, and Bulgaria, subject always to the approval, previously obtained, of the Controller of Coal Mines or his duly authorized representative, and subject to shipment being made in a vessel approved by the Commissioners of Customs and Excise or their officers. The Customs authorities will require pre-entry to be made in all cases; and at ports where there is a duly authorized local representative of the Controller of Coal Mines, the approval referred to above will be signified by his endorsement on the pre-entry form, which must be presented to him for the purpose before shipment. Where shipment is proposed to be made from other ports, it will be necessary for application for the Controller's approval to be made to the Export Branch of the Coal Mines Department in London. Similarly, shipments from all ports in the United Kingdom to destinations excluded from the purview of the general licence must still be covered by an export licence from the Coal Mines Department.

GAS HEATED HOT WATER SUPPLY
BOILER MAINTENANCE

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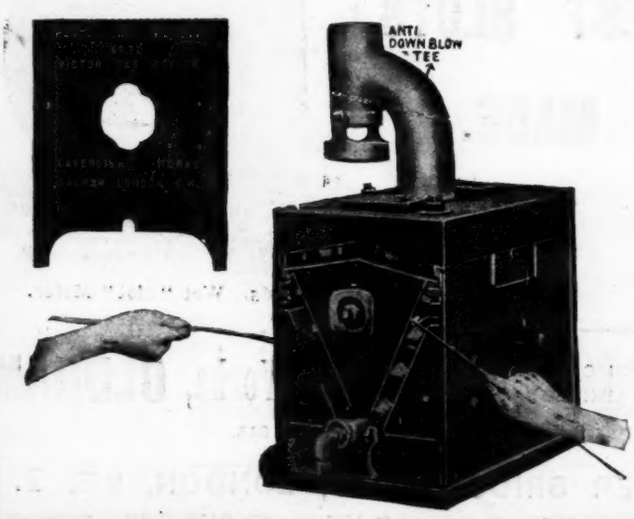

THOMAS POTTERTON,

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Coal Practically Exhausted at Durham.—According to a statement which appeared in a local paper last week, the Durham Gas Company had at that time only one-and-a-half day's supply of coal in hand; and in view of the approaching holidays, the consumers were asked to exercise the strictest economy in the use of gas, so as to help the Company through the difficulty.

Electric Lighting Restricted at Hull.—The Hull Fuel Overseer issued an order last week prohibiting all outside and inside display of electric lighting at shops between the hours of 3 and 5 in the afternoon—Saturdays excepted. The order also applies to cinema halls and places of public entertainment; while all other users of electricity, including industries, must reduce their consumption by one-third. The Fuel Overseer, upon being interviewed by a deputation of shopkeepers, who stated that window displays were an important feature of the Christmas trade, stated that the action was necessary owing to the shortage of coal, and the fear of a breakdown at the Corporation electricity works, consequent upon the excessive demands now being made upon the undertaking.

Mrs. J. Curry, of Belfast, was found in an unconscious condition in her kitchen, with a gas-jet in her mouth. She died in hospital shortly afterwards.

The Banff Gas Company have intimated to the Town Council that the gas-works are for sale; and the Council have remitted the matter to the Lighting Committee.

The Directors of Messrs. Gibbons (Dudley), Ltd., have declared dividends on the preference and ordinary shares of 7 p.ct. per annum, free of income-tax, for the six months ending Dec. 31.

Florrie Banora (aged 43) died in the Royal Infirmary at Chorlton-on-Medlock last Saturday morning, from the effects of burns. Her clothing is believed to have caught fire as she was lighting a gas-stove.

A reunion of the members of the British Gas Light Company's ambulance workers, which took place at the Company's works in Hull, was presided over by Mr. Harold E. Copp, the Manager, who was supported by Mr. John Young, the late Manager. The men recently demobilized were given a hearty welcome.

The Falkirk Town Council passed a resolution to bring under the notice of the Fuel Controller the inferior quality of coal being supplied to the Gas Department. The Convener of the Gas Committee said that the coal they were now receiving was utterly useless; they could not possibly make gas and could get no bye-products.

The Colwich (Stafford) Parish Council have had under consideration the question of a supply of gas for the district, and have addressed a letter to the Rugeley Town Gas Company asking for terms. In a reply, which it was reported was received last week, the Company have suggested a postponement of the scheme while the cost of labour and materials was so high. It was therefore decided to leave it for the present.

It was reported to the Audley (Staffs) Urban District Council on Wednesday last that the Kidsgrove Gas Light Company had informed them that the bad lighting of the Talke district, of which they had complained, was due to the unsatisfactory condition of the mains. This explanation was not regarded as sufficient; and the Council are considering an automatic lighting scheme for the district.

The twenty-first annual general meeting of James Milne & Son, Ltd., of Edinburgh, was held last Friday when the Directors' report and accounts for the year ended Sept. 30 were presented. Sir John Cowan, the Chairman of the Company, after commenting on the satisfactory results of the year, said that given freedom from labour troubles and Government interference, the prospects for the current year were encouraging. The Directors' recommendation to pay a dividend of 10 p.ct., free of income-tax, was unanimously approved, as also the carrying of £10,000 to the reserve fund.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for Dec. 17.]

Nos. 30,616—31,312.

BUCHANAN, K.—"Clip for sealing burst pipes." No. 30,620.
BURY, E.—"Apparatus for electrostatic deposition of particles from gases." No. 31,066.
FLETCHER, E. H.—"Gas cooking-stoves." No. 31,249.
GROUT, S.—"Gas-fittings." No. 30,809.
HARTLEY, H.—"Gas grilling-apparatus." No. 30,735.
HARTLEY, H.—"Heating furnaces or chambers by liquid fuel, and burners therefor." No. 30,736.
LEGARD, G. P.—"Gas turbine engine." No. 31,260.
M'EWEN, S.—"Carbonization or destructive distillation." No. 31,073.
M'INDOE, R. W.—"Prepayment meters for gas, &c." No. 31,132.
MASCHINENBAU-AKT.-GES. BALCKE ABTEILUNG MOLL.—"Gas-furnaces for air-blast heaters." No. 31,222
MASCHINENBAU-AKT.-GES. BALCKE ABTEILUNG MOLL.—"Gas-fired furnaces." No. 31,223.
MASCHINENBAU-AKT.-GES. BALCKE ABTEILUNG MOLL.—"Safety gas-furnaces." No. 31,224.
MUNTZ, W. E.—"Regulating flow of liquids." Nos. 31,216, 31,217.
RICHMOND GAS STOVE AND METER CO.—See Hartley. Nos. 30,735, 30,736.
SKINNINGROVE IRON COMPANY.—See Bury. No. 31,066.
SKIPP, G.—"Mantle-bar grid for gas hot-plates and stoves." No. 31,256.
TAUNTON, R. P.—See M'Indoe. No. 31,132.
TAYLOR, C.—"Gas-burners." No. 31,129.
UNDERFEED STOKER COMPANY.—See M'Ewen. No. 32,073.

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No. 261. Dry "Slot" Meter.

THE BEST SLOTS MADE.

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STOCK MARKET REPORT.

BUSINESS on the Stock Exchange last week was under the cloud of the approaching holidays, and this to an extent prejudicially affected some markets without their having any internal weakness. The tone at the opening was firm, and continued awhile to be very fair; but things grew gradually more and more languid, and animation had pretty well died away by the close.

All things considered, the gilt-edged market was in fairly good case. Home Government issues advanced, but tailed-off later on, and finished very little higher than the week before. Consols were 50½-51, War Loan 90$\frac{11}{16}$-91⅛, Funding 75⅜-76, and Victory 80-80¾.

Home Rails opened in pronounced demand, and, after a momentary check, held their ground right up till the close. Canadians did fairly well, and Argentines were quite strong.

The Foreign Market was sensitive. French fluctuated in view of the unsteady exchange prevailing. Greek, Dutch, and Spanish were somewhat weaker; but Chinese displayed steadiness.

The Miscellaneous Department was very mixed. Rubber showed strength, but did not maintain it entirely. Oil rose; then receded on profit realizations; and finally made a recovery. Among the firmer lines were Banks, Insurance, and Textiles.

Business in the Gas Market was on a very fair scale, considering the general slackening, and the distribution was more even. The tendency was steady for the most part, and changes in quotation were very few; but the two leading London Companies had not quite arrested their retrogression. In Gas Light and Coke, the ordinary was 2 points and the preference was 1 point easier, and South Metropolitan receded 2. In Continentals, European was ¼ lower; but Imperial Continental advanced 1.

Bargains done for cash during the week were as follows: On Monday, Alliance and Dublin 47½, 47¾, Commercial 4 p.ct. 57⅛, ditto debenture 50, European 11, Gas Light ordinary 58, 59, 59½, ditto preference 65¾, Imperial Continental 133½, 134½, 135, 135½, 136½, Liverpool 60⅜, South Metropolitan 59½. On Tuesday, Bombay 5, Cape Town debenture 64, Croydon "B" 99⅞, Gas Light ordinary 57, 58, 58⅛, ditto preference, 64, 65, 65¾, 66, ditto debenture 50⅜, 51¼, Hastings and St. Leonards 5 p.ct. 57, 57½, ditto 3½ p.ct. 40¾, 40¾, Imperial Continental 135½, 136, 136½, Primitiva 35s., 36s. 3d., ditto preference 63s. 9d., South Metropolitan 58½, 58⅞, Southampton 62, Horley 10 p.c. "A" 60. On Wednesday, Bournemouth "B" 10$\frac{7}{16}$, 10½, European 10⅞, Gas Light ordinary 56, 57½, 58½, 59½, Imperial Continental 134½, 135, 135½, 136, 136½, Primitiva preference 62s. 6d., 65s., South Metropolitan 58½. On Thursday, Bombay 5¼, Brentford "B" 55½, European 10½, Gas Light ordinary 57½, ditto debenture 51, Imperial Continental 136, 137, Primitiva preference 62s. 6d., 63s. 9d., 65s., 65s. 6d., 66s. 3d., South Metropolitan 59½. On Friday, Gas Light ordinary 56½, 57½, ditto debenture 50½, 51¼, Imperial Continental 135½, 136, 136½, ditto debenture 81½, Primitiva 32s. 6d., ditto preference 62s. 6d., 62s. 9d., South Metropolitan 57, 58½, Tottenham "B" 53½, Ilfracombe 5 p.ct. 58½.

In the Money Market, rates ruled quite easy for awhile, when they steadied, and later on became firm in response to the demand. The price of silver touched 79⅛, but closed rather lower. The Bank rate is 6 p.ct., as fixed on Nov. 6.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Shares.	When last Dividend.	Ante-War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
182,049	Stk.	July 31	4	4%	Aldershot 4 p.c. Pref.	..	60—65	..
1,551,868	"	Sept. 26	2½	2⅞	Alliance & Dublin Ord.	59—64	45—50	47½—47¾
274,000	"	July 11	4	4%	Do. 4 p.c. Deb.	76—79	62—64	..
280,000	5	Oct. 30	7½	8%	Bombay, Ltd.	5⅛—5⅜	5—5⅛	5—5⅛
50,000	10	Aug. 28	16	12%	Bournemouth Gas and Water { 10 p.c.	22—30	19—20	..
382,110	10	..	7	7%	B 7 p.c.	15—15½	10—11	10$\frac{7}{16}$—10½
115,000	10	..	6	6/.	Pref. 6 p.c.	13½—14	9½—9¾	..
159,740	—	June 27	—	4%	4 p.c. Deb.	..	56—57	..
992,045	Stk.	July 11	14	37/-	Brentford A Consolid.	261—266	56—61	..
734,220	"	..	11	31/8	Do. B New	204—209	52—57	55½
55,000	"	..	5	5%	Do. 5 p.c. Pref.	109—111	76—78	..
231,400	"	Dec. 11	4	4%	Do. 4 p.c. Deb.	91—93	64—66*	..
214,775	"	Sept. 11	11	7½%	Brighton & Hove Orig.	208—213	128—128	..
344,220	"	..	8	5⅞%	Do. A Ord. Stk.	154—159	84—89	..
933,500	Stk.	..	5	5%	Bristol 5 p.c. max.	..	..	..
580,000	20	Sept. 26	12½	10%	British	44—45	25—27	..
120,000	Stk.	June 27	4	4%	Do. 4 p.c. Deb. Stk.	88—90	63—65	..
245,771	"	..	4	4%	Buenos Aires 4 p.c. Deb.	85—87	50—58	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	6½—7½	..
100,000	10	Oct. 30	—	4½%	Do. 4½ p.c. Pref.	4—6	6½—7	..
100,000	Stk.	June 27	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	61—66	64
157,150	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	..	..
1,518,280	"	Aug. 14	5/0/4	33/4	Commercial 4 p.c. Stk.	106—108	56—61	57½
560,000	"	..	5½	26/8	Do. 3½ p.c. do.	102—105	52—57	..
475,000	"	Dec. 11	8	8%	Do. 3 p.c. Deb. Stk.	69½—71½	49—51*	50
300,000	"	"	4	—	Continental Union Ltd.	75—79	30—35	..
200,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	40—60	..
51,600	Stk.	Aug. 28	14½	12%	Croydon A 10 p.c.	..	135—145	..
278,400	—	"	11½	9%	Croydon B and C 7 p.c.	..	95—105	99¾
492,270	Stk.	—	6	5⅛%	Derby Con. Stk.	128—135	..	..
55,000	"	..	4	4%	Do. Deb. Stk.	102—104	..	..
1,002,180	10	July 30	10	8/0	European, Ltd.	17½—18	10¾—11¾	10½—11
16,298,975	Stk.	"	4/17/4	80/-	Gas { 4 p.c. Ord.	98—102	58—59	56—59½
2,600,000	"	"	8¼	26/8	Light { 3½ p.c. max.	76—79	44—46	..
4,062,285	"	..	4	4%	and { 4 p.c. Con. Pref.	96—99	64—67	64—66
4,674,850	"	Dec. 11	8	8%	Coke { 3 p.c. Con. Deb.	73½—74½	50—52*	50½—51½
190,000	"	..	10	10%	10 p.c. Bonds	..	..	..
82,500	"	Sept. 11	5	4⅛%	Hastings & St. L. 5 p.c.	..	57—62	57—57½
858,740	"	"	8½	2⅞%	Do. 3½ p.c	37—39	40—45	40½—40¾
70,000	10	April 29	11	7⅞	Hongkong & China, Ltd.	16½—16¾	8½—9½	..
56,500	Stk.	Aug. 28	9	8½%	Hornsey 7 p.c.	..	90—95	..
121,000	"	Sept. 11	7½	6⅜%	Ilford A and C.	151—154	88—93	..
65,780	"	"	6½	4⅛%	Do. B	115—118	67—72	..
65,500	"	June 27	4	4%	Do. 4 p.c. Deb.	92—94	61—64	..
4,240,000	"	May 14	9	4½%	Imperial Continental	156—160	134—139	133½—137
1,325,000	"	Aug. 14	8½	8½%	Do. 3½ p.c. Deb. Red.	84—88	81—85	81½
285,349	"	Sept. 11	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	86—91	..
1,498,986	"	Feb. 26	10	4/6	Liverpool 5 p.c. Ord. { A	211—215	..	60⅜
						146—148		
806,068	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	..	..
165,736	"	Aug. 14	7/6/6	32½%	Maidstone 5 p.c.	..	56—61	..
75,000	5	June 11	6	5%	Malta & Mediterranean	4½—4¾	1¾—2¼	..
950,000	100	Oct. 1	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	90—97	..
541,920	Stk.	Nov. 27	4	5%	Monte Video, Ltd.	11½—13	73—78	..
1,875,892	"	July 30	4½	3⅝%	Newcastle&Gateh'd Con.	98½—99½	69—70	..
599,795	"	June 27	8½	3⅝%	Do. 3½ p.c. Deb.	85—88	57—68	..
15,000	10	Sept. 11	—	11%	North Middlesex 10 p.c.	..	12½—13½	..
55,940	10	"	7/14/0	7/-	" " 7 p.c.	14—15	9—9½	..
900,000	Stk.	Nov. 27	8	8%	Oriental, Ltd.	117—122	102—105	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	4⅜—5½	..
60,000	50	Aug. 28	18	7½%	Portsea, Island B	128—131	60—66	..
100,000	50	"	12	6⅛%	Do. C	118—121	54—57	..
949,980	5	April 29	8	—	Primitiva Ord.	5⅛—5	1½—2	32/6—36/3
499,956	5	June 26	6	—	Do. 5 p.c. Pref.	4½—5	3—3½	62/6—66/3
931,600	100	Dec. 1	4	4%	Do. 4 p.c. Deb.	97—98	70—72	..
600,000	Stk.	July 30	4	4%	Do. " " 1911	..	49—52	..
946,196	"	June 27	4	4%	River Plate 4 p.c. Deb.	86—87	49—52	..
150,000	10	Sept. 26	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	7½—8	..
195,000	50	July 2	5	5%	5 p.c. Deb.	47—49	40—42	..
185,000	Stk.	Aug. 28	10	5%	Sheffield A	228—234	75—80	..
909,984	"	"	10	5%	Do. B	223—234	75—80	..
528,500	"	"	10	4⅜%	Do. C	220—222	75—80	..
188,201	Stk.	Sept. 12	4	4%	Shrewsbury 5 p.c.	..	..	..
90,000	10	Oct. 15	9	10%	South African	10½—11½	12—13	..
6,009,895	Stk.	Aug. 14	5/4/0	80/-	South Met. 4 p.c. Ord.	111—113	57—60	57—59½
950,000	"	July 11	—	5%	Do. Pref.	..	94—96	..
1,895,645	"	"	8	8%	Do. 3 p.c. Deb.	72½—74½	51—54	..
234,820	"	Aug. 14	8½	5%	South Shields Con. Stk.	157—160	104—106	..
962,795	"	"	6	3⅞%	S'th Suburb'n Ord. 5 p.c.	114—116	68—73	..
187,558	Stk.	June 27	5	5%	Do. 5 p.c. Deb. Stk.	116—118	80—85	..
647,740	"	Nov. 13	7½	3⅞%	Southampton Ord.	99—103	61—68	62
121,275	"	June 27	4	4%	Do. 4 p.c. Deb. Stk.	..	63—66	..
120,000	"	Aug. 14	—	4½%	Tottenham { A 5 p.c.	186—188	70—76	..
783,275	"	"	6	3⅝%	B 3½ p.c.	115—117	50—55	53½
181,255	"	Dec. 11	4	4%	District { 4 p.c. Deb.	87—89	63—66*	..
189,880	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	98—95	45—50	..
286,476	Stk.	Sept. 26	5	3⅛%	Tynemouth 5 p.c. max.	103½—109	74—76	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	"	Aug. 28	8½	55/-	Wandsworth A 5 p.c.	151—156	85—90	..
255,686	"	"	6¼	40/-	Do. B 3½ p.c.	129—134	63—68	..
108,075	"	"	—	38/6	Do. C	..	63—68	..
140,865	"	"	—	38/6	New Ordinary	..	63—68	..
862,000	"	"	6½	38/9	Wimbledon 5 p.c.	117—122	65—70	..
98,000	"	"	6⅔	40/-	Epsom 5 p.c.	121—126	65—70	..
88,416	"	June 27	8	8%	3 p.c. Deb. Stk.	66—69	49—51	..

* Ex Div.

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Portsmouth.

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(GAS DEPARTMENT.)

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Applicants must be Experienced in all Up-to-Date Methods of Distribution, including High Pressure Supply, and be capable of Advising Consumers in the use of Modern Gas Appliance.
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A. MACKAY,
Chief Engineer and General Manager.
Gas Offices, Longton, Stoke-on-Trent,
Dec. 19, 1919.

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